

# JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY



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NOTES ON PORTUGUESE PSYCHIATRY

*Diogo Furtado*

PSYCHIATRIC MANIFESTATIONS IN PANCREATIC DISEASE

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INTERNATIONAL RECORD OF CLINICAL AND RESEARCH PSYCHIATRY

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The JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY is dedicated to the search for the fundamental factors in the etiology and pathogenesis of psychiatric disorders; to the training of an alert, progressive, and qualified psychiatric personnel; and to the stimulation and support of all phases of psychiatric service and research—biologic, chemical, psychologic, physiologic, and social.

In the pursuit of these aims, the JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY will venture wherever the quest may lead. Its sole criterion will be the promise of an increment in the understanding of the mind's ills. It will seek, above all, to bridge national boundaries, language barriers, and the artificial demarcations of schools and trends.

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# JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY

VOLUME XIII, NUMBER 1, JANUARY-MARCH, 1952

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# JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY

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# JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY

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## Notes on Portuguese Psychiatry

*Diogo Furtado*

The author of this essay does not pretend to give the reader an exact or complete panorama of Portuguese psychiatry. He seeks only to provide a very general sketch of its evolution, and at the same time to indicate the present-day trends of this curious, rather recent arrival on the scene of world psychiatry.

Although Portuguese psychiatry has become known, one might say even made famous, through the advent of lobotomy and by the awarding of the Nobel Prize for Medicine to Egas Moniz, it contains other facets which well deserve the attention of specialists of other countries. It is mainly these particular qualities which we shall attempt to bring into relief in these brief notes.

A few words on the development of treatment of the insane in Portugal will serve to outline chronologically the evolution of the Portuguese school of psychiatry.

The first outstanding event connected with the treatment of the insane, and involving Portugal, does not occur in that country. As a matter of fact, João Cidade, a Portuguese pilgrim who was later canonized as St. João de Deus, founded in Granada, Spain, in 1538, a small hospital to which he himself, and later benefactors attracted by his example, brought mental cases, among other patients.

At that time, there already existed in Valencia, Spain, a mental institution founded about a century earlier through the initiative of Friar Juan Joffre; and it appears that nowhere else, at that time, were mental cases treated in special institutions. João Cidade's work was just the first step and today the 34 mental hospitals, accommodating 15,000 mental patients, which the Order of St. João de Deus runs all over the world, do not especially reflect their remote Portuguese origins.

The first information available concerning the treatment of the insane in Portugal dates from 1539 when the patients were confined to a separate wing of the great hospital in

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Lisbon, the All-Saints Hospital (Todos-os-Santos). And a royal edict which recommended a certain priest in certain cases "because said person had much experience and could do much for them" shows not only an interest in such patients but points to an incipient psychotherapy which, resting on a religious rather than medical basis, was already proving itself useful.

It is with the history of this great hospital, one of the major institutions in Europe between 1500 and 1755, that help to the insane in Portugal is connected. When it was destroyed in 1755 by the great earthquake of Lisbon, the patients were transferred to the St. Joseph Hospital which succeeded it and exists to this very day.

It was in 1848 that the first hospital devoted to the treatment of mental cases was founded in Lisbon. In that year, the Duke de Saldanha set up the Rilhafoles Hospital in an old convent.

This hospital played one of the principal roles in the history of Portuguese psychiatry. The only one in the country until 1883, for the first few years after its establishment it enjoyed a golden age during which it was constantly being improved. Later, coinciding with a long eclipse of Portugal as a power, the hospital entered a decline from which it began to emerge only when the innovating spirit of Bombarda took it over. Miguel Bombarda initiated the teaching of psychiatry in Portugal, and the Rilhafoles Hospital, which today bears his name, became the Mecca for students attracted there by the strong, unmistakable personality of that alienist. Between 1892, when Bombarda assumed the direction of the hospital, and 1910 when he died there, the victim of a maniac, the study and teaching of psychiatry were started at Rilhafoles. The study of other specialties began as well, such as histology, physiology and legal medicine, thanks to men of the stature of Mark Athias, Celestino da Costa and Azevedo Neves, whom Bombarda made his collaborators.

In 1883 the Conde de Ferreira Hospital was founded in Oporto by private endowment, and with it psychiatry entered the northern regions of the country. And in 1893 there was established in Portugal the Order of St. João de Deus, created by a Portuguese, and many hospitals were gradually set up by it.

After the tragic death of Bombarda and the establishment of the Republic (two events which took place the same day) the first law to reform the treatment of the insane was passed, but it accomplished little or nothing. Rilhafoles became Bombarda Hospital, psychiatric instruction was officially begun in Lisbon as well as in Oporto and Coimbra, but the mentally ill were still deplorably neglected. During this period (1912-1938) the direction of the Miguel Bombarda Hospital was undertaken by two eminent psychiatrists who were the real fathers of modern Portuguese psychiatry: Julio de Matos and Sobral Cid. The former, in addition to a textbook on psychiatry which already reflected the modern trends which he derived from Kraepelin, left several interesting works on legal psychiatry. Sobral Cid was the teacher and guide of the most respected Portuguese alienists of today. Very well grounded in the German schools of psychiatry, a great admirer of Bleuler whose psychoanalytic conception of schizophrenia he adopted in a memor-

able lecture, Sobral Cid, a master of style and a fascinating speaker, has left us several medico-legal reports and a few speeches which may always be re-read with pleasure. His influence, however, cannot be measured by what he wrote. It was rather his personal charm, his great power of clinical analysis, which inspired many of us to enter the field of psychiatry.

In 1936 occurred the event which made Portuguese psychiatry world-famous: Egas Moniz was not only professor of neurology, but also an eminent student of psychiatry who, a number of years earlier, had made the memorable discovery of cerebral angiography, the value of which time has served to enhance; and in 1936 he experimented with leukotomy as a new treatment for mental illnesses.

Patients both of the Neurological Clinic and the Hospital under Sobral Cid's direction were used by Egas Moniz at the start. His method created little stir in Portugal at first, however, and it was only after a long discussion published by Freeman and Watts that leukotomy came to be regarded with renewed interest in the country of its origin.

In 1942 Lisbon saw the opening of the Julio de Matos Hospital, the best institution for psychiatric aid in the country; next the excellent Sobral Cid Hospital was organized in Coimbra along farm-settlement lines. And finally, in 1945, laws were passed creating a vast network of aid for the insane and for the furthering of mental hygiene, covering the entire country and embracing the aforementioned mental institutions.

The old Miguel Bombarda Hospital in which psychiatric instruction was given until 1942 (when the Psychiatric Clinic of the Faculty was transferred to the Julio de Matos Hospital) underwent, in the meantime, considerable improvements which turned it into a modern hospital and which are intimately tied up with the name of its present director, Dr. Almeida Amaral.

Before outlining a panorama of the contemporary orientations of Portuguese psychiatry, it would be proper to recall a few more names from the past which, together with those already mentioned, would help to illustrate our subject: Antonio Maria de Sena and Magalhães Lemos, both from Oporto, and Elysio de Moura of Coimbra, eminent psychiatrists who in their time acquired justified renown.

From the time of Sobral Cid, phenomenological orientation has largely dominated Portuguese psychiatry. An impassioned researcher and analyzer of symptoms, Sobral Cid inculcated in his collaborators a preference for psychopathology and an objective clinical sense which have prevailed to this day. Highly influenced by German psychiatry, the master of the Lisbon school created in Portugal a type of psychiatry in which German methods, concepts and classifications were totally accepted to the obvious detriment of other currents of psychiatric thought. His influence and the excellent medical education of the psychiatrists who studied under him (an education to which the lofty mind and example of the Professor of Clinical Medicine and former assistant professor of psychiatry, Pulido Valente, contributed greatly) are mainly responsible for the fact that purely psychogenic orientations, and particularly psychoanalysis, made little headway in Portugal. As a matter of fact, Portugal is one of the countries in which Freudian doctrines have



been most unenthusiastically received: the works of purely psychoanalytic orientation to be found in the Portuguese psychiatric bibliography are insignificant in number, and the psychiatrists who in this country practice orthodox psychoanalysis, or anything like it, may be counted on the fingers of one hand.

Of the many disciples of Sobral Cid, those who most influenced the subsequent development of Portuguese psychiatry are Barahona Fernandes, Almeida Amaral, Fernando Ilharco, Fernando Ferreira, and Diogo Furtado.

Barahona Fernandes is at present professor of psychiatry at Lisbon. He is the author of many valuable works of which the most interesting and original are those which treat of the "converging point of view" in psychiatric analysis, an extension of the idea of multidimensional analysis of Birnbaum and Kretschmer, and those which study the pathology of psychomotility, in which Barahona Fernandes broadened and completed the investigations of Sobral Cid on the comparison of catatonic with extrapyramidal hypercinesias.

After having been the most important Portuguese advocate of ergotherapy, in the last few years Barahona Fernandes has become the true theoretician of lobotomy. He is a stubborn defender of this method, and the report which he presented to the latest International Congress of Psychiatry represents the finest psychopathological contribution yet made to the study and interpretation of the results of lobotomy.

The school of psychiatry he created at the Julio de Matos Hospital boasts of several young psychiatrists of considerable stature. Because of the importance of their published works we must at least mention the names of Luis Soeiro, Seabra Diniz and Pedro Polonio. The hospital operates a neurosurgical section where Almeida Lima, the surgeon who performed the first leukotomy along the lines suggested by Moniz, continues operating on mental patients.

Almeida Amaral particularly distinguished himself in the field of psychiatric aid. He did so much to re-invigorate the Miguel Bombarda Hospital that it is now on a par with the most modern psychiatric institutions; he is also the author of a monograph in defense of lobotomy, and of various other works on clinical psychiatry.

Fernando Ilharco, the disciple who most intimately collaborated with Sobral Cid, has played an outstanding role in psychiatric aid, and is in charge of this work in the south of Portugal. He has contributed much to the extraordinary growth of psychiatric aid which is fundamentally due to governmental action, and which has been gaining momentum since 1943.

Fernando Ferreira, whose psychological and philosophical background is vast, and who for several years visited the German clinics, preferred to leave his homeland, and is at present the director of the Clinic and Psychiatric Home of the most important city in the vast Portuguese colonial empire, Lourenço Marques.

Diogo Furtado, the director of the Neurological Section of the Lisbon hospitals, has been equally influential in the evolution of Portuguese psychiatry. His is an essentially medical and neurological orientation, and his many publications always reflect these points of view. Thus, his writings on the psychopathological syndromes of avitaminoses and



endocrinopathies and his essays on many modern therapeutic methods, several of which were read before the latest International Congress of Psychiatry, bear witness to his clinical orientation and to his tendency to relate the pathology of the mind, not only to the pathology of the brain but to the totality of the organism. Both he and his collaborators (outstanding among whom are Miranda Rodrigues, Francisco Alvim, and Vasco Chichorro) are more than pure psychiatrists; they are essentially neuropsychiatrists whose investigations into organic pathology of the nervous system outweigh those on mental pathology.

Barahona Fernandes and Diogo Furtado are members of many foreign societies and are quite well known outside their own country.

In addition to these names which have most influenced the development of Portuguese psychiatry, a few others deserve to be mentioned. In fact, a group of young psychiatrists in Oporto, like Gregorio Pereira, Azevedo Fernandes, Pimentel Neves, Teixeira de Sousa and others, in the majority disciples of the principal psychiatrists of Lisbon, manage to do useful work in spite of the unfavorable conditions with which they must contend. Their published works on psychogenesis and psychotherapy, particularly on group psychotherapy, reveal great knowledge and point to even greater accomplishments in the future.

In Coimbra, scientific progress has been slower and working conditions even worse. The foremost psychiatrists there are Correia de Oliveira, Granada Alfonso and Nunes Vicente, among others.

Having discussed individuals, we turn our attention to the attitudes which collectively show where Portuguese psychiatry stands in relation to the major problems of world psychiatry today.

We have previously mentioned what little influence psychoanalysis has had in Portugal. The widely-acknowledged paradoxical fact that psychoanalysis, which entrenched itself so firmly in the western hemisphere, has attracted so few adherents in European countries either as a pathogenic doctrine or a therapeutic method, is perhaps most acute in Portugal. The practice of psychoanalysis by non-doctors is forbidden by the law regulating the Order of Physicians; and psychiatrists, all educated in the phenomenological and clinical-organicist approach, use at best abbreviated methods, and only in rare cases do they practice orthodox psychoanalysis.

As occurs in many other countries, psychoanalysis in Portugal has found its warmest reception in literary circles which are attracted by the sexual revelations rather than the technique of psychiatric practice. It should be emphasized, however, that the mentality of the Portuguese people, strongly colored by religious ideas and full of traditionalistic and moralistic preoccupations, represents perhaps the strongest reason for the failure of psychoanalysis and explains the reluctance on the part of psychiatrists to apply it systematically.

The same has not been true of the psychosomatic trend which, after influencing all of medicine, emerges before us as a method that originated in America. Imbued with a medical and organicist orientation, Portuguese psychiatrists since Sobral Cid recognize and practice true psychosomatic pathology in all its relations with internal medicine.

The systematizations and defining viewpoints that American psychiatry brought to this treatment of the total human being—an idea born with Hippocrates and attaining its maximum expression in Von Bergmann—were therefore easily accepted by Portuguese psychiatrists. We might even say that, with regard to corporal medicine, Portuguese psychiatrists have more or less consciously and deliberately modeled their practices along the lines of what we today call "psychosomatic medicine."

Governed by tendencies much more organistic than philosophical, it is not to be wondered that the influence of schools such as the Gestalt or the Existentialist which distinguish the philosophical orientation of psychiatrists in other countries, has hardly made itself felt in Portuguese psychiatry. The Portuguese are generally quick to receive and try anything having to do with medical experimentation, and thus, as a rule, new therapeutic methods and pharmacological innovations are enthusiastically welcomed. But, on the other hand, we are so little given to speculation that it would be hard to find such philosophical indifference among the psychiatrists of any other cultured people.

It can be said, therefore, that an essentially medical psychiatry is practiced in Portugal, and this is perhaps the main virtue of Portuguese psychiatry.

With regard to modern therapies employed, the vogue of shock treatments in Portugal is truly extraordinary, the electric shock being widely used with resident as well as with out-patients. The number of insulin comas brought about daily in any of the Portuguese psychiatric clinics is very high. The general impression is that shock treatments are a useful means of shortening the duration of recurrent psychoses and provide relief for mental cases formerly thought incurable.

Occupational therapy is also emphasized in Portugal, the majority of confined patients being subjected to various methods of ergotherapy. Group psychotherapy, only in its beginning stages, is already achieving a certain importance among the therapeutic methods employed.

Progress with regard to lobotomy deserves special mention. Given its position, so intimately connected with somatic pathology, it would seem at first glance that Portuguese psychiatry ought to be the ideal soil for the growth of a therapeutic method such as lobotomy, devoid of theoretical bases and essentially finalistic, especially since this method was due entirely to the studies and experiments of an eminent Portuguese, Professor Egas Moniz.

This has not been the case, however. After the original tests made by Egas Moniz on just a few dozen patients, lobotomy was received not too favorably from 1936 to 1946. Very few operations were performed, and it is probable that this treatment would have been forgotten were it not for the work of Freeman, which commanded world attention. Indeed, one might say that lobotomy was again discussed and attempted by Portuguese psychiatrists only because of the interest it excited in so many other countries and the increasing number of publications on the subject. With regard to lobotomy Portuguese psychiatrists today fall into three categories corresponding more or less to groups in all other countries. The first group comprises the conscious advocates of lobotomy and in-

cludes the psychiatrists at the Julio de Matos Hospital under the leadership of Barahona Fernandes. The views of this illustrious psychiatrist, set forth in his report to the Congress of 1950, are well known; equally famous is his notion of regressive syntonization, conceived by him in order to interpret post-lobotomy behavior. It must be said, however, that those who advocate lobotomy in Portugal adopt a more reserved attitude towards the techniques of operation than is held, for instance, in the United States.

The second group is made up of the majority of Portuguese psychiatrists whose attitude towards lobotomy is not one of hostility, but rather of reluctance. Because of moral and religious preconceptions (often unconscious), material difficulties standing in the way of successful operation, and skepticism with regard to observed results, many Portuguese psychiatrists have never even been inclined to recommend lobotomy.

The last group is made up of the deliberate opponents of lobotomy. Their arguments are well known as they are the same as those adduced in other countries. Several works by Diogo Furtado express this point of view; and it is, in fact, around this psychiatrist that the principal nucleus of opposition to lobotomy has gathered. One may venture the generalization that psychosurgery, largely the work of one of the most enlightened spirits of Portuguese science, Egas Moniz, has met with very little enthusiasm on native grounds. Orbital lobotomy, topectomy, cortical undercuttings have been performed only rarely. It is unlikely that the number of lobotomized patients which, at the time of the International Conference of Psychosurgery (1948) scarcely reached two hundred, has been doubled since then. And the present trend manifestly does not foreshadow any increase.

Many important facts and personalities worthy of mention have probably escaped us in this rapid review of the general state of present-day Portuguese psychiatry. Such possible omissions have been in no wise intentional, but rather the inevitable consequence of a desire to limit this essay to proportions compatible with the interest of our readers.

#### SUMMARY

The author begins with a short story of Portuguese psychiatry. He remembers the name of S. João de Deus, a Portuguese native, who played a great role in the treatment of the insane, and emphasizes the importance of the All-Saints Hospital of Lisbon, where such patients were treated since 1539. After noting the foundation of the first hospital devoted to the treatment of mental cases, by Duke of Saldanha, the author follows the evolution of Portuguese psychiatry until the present days. The names of Sobral Cid and Julio de Matos are presented as the great teachers of the actual Portuguese alienists.

The great progress accomplished by the promulgation of the new laws on psychiatric organization and the opening of new hospitals is stressed.

The author then outlines the personalities of the main Portuguese alienists, and the contemporary orientations that psychoanalysis and philosophical orientations have had in the evolution of Portuguese psychiatry, and, on the contrary, its medical tendencies. He refers to lobotomy, a discovery of the Portuguese Nobel prize winner, Egas Moniz, and to the present position of Portuguese alienists in the forefront in lobotomy.

## RESUMEN

El autor inicia su trabajo con un breve relato de la psiquiatría portuguesa. Recuerda el nombre de S. João de Deus, un nativo portugués que desempeñó un papel importante en el tratamiento de la demencia y destaca la importancia del All-Saints Hospital de Lisboa donde se trataban tales pacientes desde el año de 1539. Después de citar la fundación del primer hospital dedicado al tratamiento de casos mentales, por el Duque de Saldanha, el autor sigue la evolución de la psiquiatría portuguesa hasta nuestros días. Presenta los nombres de Sobral Cid y Julio de Matos como los grandes maestros de los alienistas portugueses actuales.

Destaca ee gran progreso llevado a cabo por la promulgación de las nuevas leyes en la organización de la psiquiatría y el establecimiento de nuevos hospitales.

Posteriormente el autor bosqueja la personalidad de los principales alienistas portugueses y las influencias que las orientaciones contemporáneas psicoanalíticas y filosóficas han tenido en el evolución de la psiquiatría portuguesa, y al contrario, sus tendencias médicas. Hace referencia a la lobotomía, un descubrimiento del Premio Nobel portugués, Egas Moniz, y a la presente posición de los alienistas portugueses frente a ella.

## RESUME

L'auteur débute par un exposé succinct de la psychiatrie portugaise. Il rappelle le nom de S. João de Deus, un indigène du Portugal, qui a joué un rôle décisif dans le traitement des aliénés, et souligne l'importance de l'Hôpital de la Toussaint de Lisbonne, où tous les malades de cette catégorie sont soignés depuis 1539. Après avoir relaté la fondation du premier hôpital consacré au traitement des aliénés, par le Duc de Saldanha, l'auteur passe en revue l'évolution de la psychiatrie portugaise depuis cette époque jusqu'à nos jours. Les noms de Sobral Cid et de Julio de Matos sont signalés comme les deux principaux créateurs de l'aliénisme moderne au Portugal.

L'étude met également en évidence les progrès remarquables accomplis par la promulgation des nouvelles lois relatives à l'organisation psychiatrique, ainsi que l'ouverture de nouveaux hôpitaux.

L'auteur donne ensuite une esquisse sur la personnalité des principaux aliénistes portugais, et sur les tendances contemporaines qu'a revêtues l'orientation psychanalytique et philosophique dans l'évolution de la psychiatrie portugaise, en contraste avec ses tendances médicales. Il fait allusion à la lobotomie, une découverte du gagnant du prix Nobel portugais, Egas Moniz, et au rang éminent occupé par les aliénistes portugais dans le domaine de la lobotomie.

# Psychiatric Manifestations in Pancreatic Disease

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Douglas Noble\**

It is the aim of this paper to call attention to those emotional factors present in malignant and inflammatory diseases of the pancreas which may play a significant role in addition to the ordinarily recognized clinical and pathological features.

Twenty years ago Yaskin reported four patients with carcinoma of the pancreas in whom symptoms of insomnia, depression, and fears of imminent disaster appeared at an early stage of the disease, complicating seriously the diagnostic problem. Yaskin expressed the view that visceral pain was responsible for the anxiety. Ulett and Parsons reviewed 87 cases of pancreatic carcinoma and found that 10 per cent presented "a psychiatric problem of some importance"; their patients showed symptoms similar to those of the agitated, depressed states.

In studies made of inflammatory diseases of the pancreas, considerable emphasis has been laid upon alcoholism as an etiological or precipitating factor. Comfort, Gambill, and Baggenstoss found a history of alcoholic excess in 68 per cent of their patients. In 150 cases of acute and chronic alcoholism seen at autopsy, Clark found evidence of pancreatic disease in 27. Weiner and Tennant noted that pancreatitis was 19 times as frequent in chronic alcoholics as in nonalcoholics; alcohol was an important factor in 68 per cent of their cases seen at autopsy; in only 16 per cent were diseases of the extrahepatic biliary tract system considered significant.

Beazell and Ivy reported that stimulation of pancreatic secretion occurred when alcohol was introduced into the isolated duodenum.

Rickles, and later Williams, have reported cases of chronic pancreatitis in which emotional disturbances were prominent.

To determine the incidence and character of such emotional disturbances, we have reviewed 80 cases of pancreatic disease admitted to the United States Naval Hospital, Bethesda, Maryland, during the past four years. Approximately 50,000 patients of all types were admitted to the hospital in this period.

## CARCINOMA OF THE PANCREAS

Of 20 individuals with proven carcinoma of the pancreas, five were admitted with complaints which despite the presence of pain and weight-loss were considered functional. The pain was discounted by the physician because it appeared exaggerated, inconsistent

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or relieved by suggestion. Three of the five developed depression, insomnia and anxiety. With these three patients the diagnosis had been complicated by a previous history of emotional difficulties. Physical and laboratory findings were minimal. In only one of the five was the diagnosis of carcinoma made before the onset of terminal symptoms. This patient had been admitted with complaints of back pain, insomnia and weight loss. He was anxious and depressed but the psychiatric picture was not in keeping with his previous life history and on this basis, together with an elevated glucose tolerance curve, a presumptive diagnosis of carcinoma of the body of the pancreas was made by the internist.

While functional symptoms were noted early in five cases of the 20 patients studied, delirium was observed as a terminal manifestation in eight instances. It is noteworthy that the single patient who had proven cerebral metastases was free from grossly observable mental disturbance. Pain, sometimes accompanied by nausea, was an initial complaint in 12 of the 20 patients: weight loss was prominent in eight. By contrast, jaundice was the presenting symptom in only four cases.

The psychiatric symptoms which accompany pancreatic carcinoma are somewhat similar to those observed in agitated, depressed states. The appearance of anxiety and depression seems to be explainable on two grounds: first, a serious onslaught upon the organism may itself produce intense anxiety associated with a feeling of impending doom; this has often been described in angina pectoris. Second, anxiety and depression may be increased by the failure of the physician to recognize the true nature of the patient's disorder. In some instances of severe physical or psychic shock, pain and anxiety may be so intense that instead of functioning as danger signals they may overwhelm and paralyze the organism from effective self-preservative action. In crises such as these, the attitude of the physician whose help is sought becomes of great importance. The patient is reassured if the physician recognizes the existence of a serious problem and proceeds methodically to investigate its nature; the diminution in anxiety will of itself help to clarify the diagnosis. If, on the other hand, the physician, because of a need to see illness as either functional or organic, concentrates his attention upon only one aspect of the clinical picture, important findings will be overlooked and the patient's anxiety and depression will be accentuated. The diagnostic problem then becomes more than ever confused.

Certain points of difference between the agitated depressed states seen in carcinoma of the pancreas and the involutional states should be mentioned. In involutional melancholia, there is usually a history of a life-time obsessional personality; the depression is often accompanied by hypochondriacal symptoms which tend, however, to be vague or bizarre and distributed throughout the body in contrast to the steady, consistent localization of the pain of pancreatic disease. Self-accusatory ideas or ideas of impoverishment are usually prominent in the involutional disorders. Further, the complaints of the involutional patients are often clearly directed against some particular person toward whom the patient's thinly veiled antagonism is evident.

The patient with pancreatic disease may show close similarities to the hysteric. Differentiation is based on the following facts. The hysteric usually shows: (1) less manifest



anxiety, (2) less intractable insomnia, (3) presence of a hysterical personality, (4) conversion symptoms whose psychologic causation can be demonstrated.

## ACUTE PANCREATITIS

The studies of histories of patients with acute and recurrent pancreatic necrosis makes it readily possible to think of these disorders in terms of a prolonged somato-psychic maladjustment. Hyperglycemia, glycosuria, and renal and hepatic impairment are often present. The clinical histories reveal that these phenomena usually develop in people with prolonged psychologic difficulties, particularly in those who have sought refuge in alcoholism.

Of 45 patients diagnosed as acute pancreatitis, 33 or 73 per cent were alcoholics. Eleven of the 45 patients, eight of them alcoholic, showed toxic mental disturbances varying from mild states of confusion to frank delirium. No correlation was observed between the appearance of delirium and the serum amylase findings.

Of the three nonalcoholic patients, one had shown increasing withdrawal from people for many years. During his acute pancreatic disease he developed transient illusions and hallucinations which subsided when he was moved from a single room to an open ward; seeing and hearing other patients, he said, brought him back to reality. Another patient became delirious soon after his admission to the hospital and died the next day. Autopsy showed hemorrhagic necrosis of the pancreas, normal gall bladder, encephalomalacia, satellitosis, neuronophagia. The duct of Wirsung was markedly stenosed.

The life histories of the alcoholic patients who became delirious revealed the existence of a wide range of conflicts for which relief had been sought in alcoholism. One patient was an incipient schizophrenic. Another showed periodic depressive reactions. There were problems of impotence, of latent homosexuality, and of marital difficulty. These problems, were often manifest in the patient's delirious productions. One patient saw visions of his dead mother warning him and heard the accusatory voice of a girl whom he had seduced. One man, a cab-driver, alternated in his delirium, between cranking his car and placing bets on the horses. Some of the patients were markedly dependent people who had failed to achieve a domestic, economic, or sexual adjustment and would have proven difficult psychotherapeutic problems at any stage of their illnesses. There were others, however, whose problems would have been accessible to psychotherapy before the vicious self-destructive cycle of anxiety-alcoholism-pancreatitis and more alcoholism had begun its course.

A comparison of the life histories and previous personalities of those alcoholic patients who developed toxic mental disturbances with those who did not failed to show grossly distinguishing features. As yet, we are unable to offer any satisfactory explanation of the role of pancreatic necrosis in contributing to the release of underlying psychopathology. Most patients who develop delirium tremens have no demonstrable pancreatic disease. We studied the serum amylase in a series of 26 chronic alcoholic patients, practically all of whom were in either incipient or full blown delirium; the serum amylase was normal in all of these patients. These studies are being pursued, but have so far failed to confirm the

findings of Domzalski and Wedge who reported the presence of elevated serum amylase in 24 per cent of alcoholic patients examined and who postulated the existence of subclinical or latent pancreatic necrosis.

#### CHRONIC RELAPSING PANCREATITIS

Fifteen patients classified as suffering from chronic relapsing pancreatitis were studied; all of them had had many attacks, lived in constant dread of another, and suffered from chronic pain. Frequently they went from one physician and from one diagnosis to another without relief. Two of them were severely depressed. Eight were chronically alcoholic. One had been treated for narcotic addiction and there were several others who relied so heavily upon narcotics that they could almost be called addicts. A 57-year-old woman with a long history of marital difficulty became disturbed and subject to crying spells following the marriage of her two children. She sought relief in alcohol and after one episode of drinking developed an attack of acute pancreatic necrosis. On arrival at the hospital a member of the medical staff scolded her severely for her drinking habit. She became afraid both of subsequent attacks and of the treatment. Her depression increased and she began to use codeine for relief of pain. Her fear of recurrent attacks was increased by the addiction and she stated that if she were to discontinue the drug she would have an attack in public.

In the treatment of both chronic and acute pancreatitis it is important to obtain at the earliest possible date a history which takes cognizance not only of the events preceding the acute attack of illness but of the life situation of the patient, the emotional problems involved, and the existence of any tendency to seek symptomatic relief of these in the use of alcohol or drugs. Sometimes psychiatric referral will be necessary, but in the early stages of difficulty an accurate appraisal of existing emotional factors by a competent internist will do much to alleviate the patient's anxiety. Weiss has amply demonstrated in his work with hypertensive patients how effective a psychiatrically oriented internist can be.

#### SUMMARY AND DISCUSSION

In a study of a series of patients with pancreatic disease, emphasis has been laid upon the complicating influence of psychologic factors. In patients with carcinoma of the pancreas, depression and anxiety — more marked, in our opinion, than is seen in other types of malignant disease — appeared to be related to: (1) the fact that the diagnosis is often missed and the patient left in a state of chronic uncertainty; and (2) some peculiar characteristic of the pancreas possibly related to its parasympathetic connections which make the patient more aware of the seriousness of the onslaught upon his organism. The nature of this manifestation deserves considerable research since it may touch upon the basic problem of anxiety.

The study of patients with pancreatic necrosis revealed a long history of somatic and psychologic maladjustment often associated with the use of alcohol and the establishment of a vicious self-destructive cycle. There was a high incidence of toxic mental disturbances during the acute attacks of pancreatic necrosis.



## MANIFESTATIONS IN PANCREATIC DISEASE

The study of the serum amylase in a series of patients with delirium tremens showed no elevation; latent pancreatic necrosis did not appear to be a factor in their disturbances.

In chronic pancreatitis, persistent anxiety, depression, and narcotic addiction were prominent psychiatric problems.

Our report has served more to call attention to the problems of pancreatic disease than to present new findings, but it gives renewed emphasis to the opportunities in this field for fruitful collaboration between internist and psychiatrist.

### RESUMEN

En el estudio de un grupo de pacientes de enfermedades pancreáticas se dió especial importancia a las complicaciones producidas por la influencia de factores psicológicos. La depresión y la ansiedad de los pacientes de carcinoma del páncreas — que en nuestra opinión son más marcadas que en otros tipos de cáncer — aparentemente están relacionadas con: (1) el hecho de que frecuentemente el diagnóstico no se hace con exactitud y el paciente queda en un estado permanente de incertidumbre, y (2) algunas características especiales del páncreas, posiblemente relacionadas con sus conexiones parasimpáticas, las cuales hacen que el paciente aprecie cabalmente la gravedad de su enfermedad. La naturaleza de esta manifestación merece ser investigada con cuidado ya que puede tener relación con el problema básico de la ansiedad.

El estudio de pacientes de necrosis pancreáticas reveló historias de desadaptación somática y psicológica frecuentemente asociadas al uso del alcohol y al establecimiento de un círculo vicioso de autodestrucción. Hubo una alta incidencia de perturbaciones mentales tóxicas durante los ataques agudos de necrosis pancreáticas.

Las determinaciones de la amilasa sérica practicadas en un grupo de pacientes con delirium tremens, no reveló aumento alguno en los valores de dicha sustancia y la necrosis pancreática, latente al parecer, no constituyó un factor determinante de su perturbación.

Entre los problemas psiquiátricos importantes en los casos de pancreatitis crónica pueden mencionarse la ansiedad persistente, la depresión y la adicción al uso de narcóticos.

Nuestro informe ha servido más para llamar la atención sobre los problemas de las enfermedades pancreáticas que para presentar nuevos hallazgos; sin embargo, ha dado nuevo interés a las oportunidades que se presentan en este campo para una colaboración productiva entre el internista y el psiquiatra.

### RESUME

Dans une étude portant sur un groupe de malades souffrant d'une affection pancréatique, on a souligné en particulier l'influence complicatrice des facteurs psychologiques. Chez les malades atteints de carcinome du pancréas, le sentiment d'abattement et d'angoisse — plus prononcé, à notre avis, que celui observé pour d'autres types d'affection maligne — a paru se rattacher: (1) au fait que le diagnostic est souvent incomplet et que le malade est laissé dans un état d'incertitude chronique, et (2) à quelque caractéristique particulière du pancréas se rattachant éventuellement à ses affiliations parasymphatiques, ce qui rend le

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sujet plus conscient de la gravité de l'attaque faite par la maladie sur son organisme. La nature de cette manifestation mérite qu'on entreprenne des travaux de recherches considérables, car il se peut qu'elle touche au problème fondamental de l'angoisse.

L'étude des sujets atteints de nécrose pancréatique a révélé de longs antécédents de déséquilibre somatique et psychologique, souvent associé à la consommation d'alcool et à l'établissement d'un cycle suicidal vicieux. On a observé une grande fréquence de dérangements mentaux de toxicité pendant les crises aiguës de nécrose pancréatique.

L'étude de l'amylase séreuse dans un groupe de malades atteints de *delirium tremens* n'a révélé aucune élévation; la nécrose pancréatique latente n'a pas paru être un facteur de leurs dérangements.

Dans les cas chroniques de pancréatite, les problèmes psychiatriques les plus couramment observés ont été l'angoisse constante, l'abattement, et la narcomanie.

Notre compte rendu a surtout servi à attirer l'attention sur les problèmes posés par l'affection pancréatique plutôt qu'à présenter de nouveaux faits, mais il met plus que jamais en lumière les possibilités qui existent dans ce domaine pour établir une collaboration efficace entre le médecin interne et le psychiatre.

## DISCUSSION

DR. EDWARD WEISS (Philadelphia, Pennsylvania):

Mr. Chairman, Ladies and Gentlemen: The authors have called attention to an interesting problem, namely, the psychological manifestations of somatic diseases. We have thought of these in regard to many other disorders (asthma, for example) in the past, in which the feeling always was, or frequently was, "Why shouldn't this person be nervous, after having such a serious disease for such a long period of time?"

Then we began to appreciate the fact that the nervousness may antedate the disorder, and that something in the social setting may touch off the conflict which precipitates the disorder.

So, during the past decade, we have been emphasizing the reverse of the situation presented today, namely, the somatic manifestations of emotional tension — this during the psychosomatic era (a term which has its disadvantages but has also been of great value to medicine in that it has served to bring attention to the fact that important revisions exist).

Our attitude toward this term is that it does not mean less study of somatics; it only means more study of the psychic. As long as we assumed that disease was either functional or organic, we were always in danger of neglecting one or another of these important elements in illness, so that the question is not either/or, it is rather more or less; that is, "How much of the problem is physiological? How much is psychological? What is the relationship between them?"

Whether the incidence of depression in carcinoma of the pancreas and other pancreatic diseases is a matter of coincidence or a specific relationship between the disease and the psyche, I do not know. But the practical importance of the subject cannot be denied; that is, that we must be on the alert to detect evidence of physical disease in psychological disorders, just as we insist upon the psychological study of patients with organic disease.

I think it is very doubtful that carcinoma of the pancreas, or other pancreatic disease, has peculiar psychological characteristics. I suspect that one of the important elements is, as the authors point out, that the obscurity of the diagnosis and the physician's concern are apprehended by the patient and add to his anxiety.

## MANIFESTATIONS IN PANCREATIC DISEASE

One additional point in this regard is suggested by a case in which there was a previous history of depression. Then, the additional symptoms of pain in the upper back and loss of weight were attributed to psychological factors.

But the psychiatrist found nothing new in the psychiatric picture and emphasized that the physician should be on his guard for new developments as far as somatic disease was concerned. Then, further study disclosed carcinoma of the pancreas.

The anxiety mechanism operates in response to various types of psychiatric indications of danger, but whether there is some obscure relationship between this life-threatening disease and some unconscious appreciation of the fact which produces mental depression is a subject about which we have all had clinical impressions, but about which, as the authors rightfully point out, we certainly need much more study in order to improve the relationship.

DR. GEORGE N. RAINES (Washington, D. C.):

Mr. Chairman, Ladies and Gentlemen: I have no information to add to the paper, which I consider an excellent and timely presentation. But I would like to express gratitude to the authors for directing our attention, again, to the fact that there is an active somatopsychic medicine as well as a psychosomatic medicine or, should we say, physiologic-psychic medicine as well as psychophysiologic medicine.

The authors have stressed the fact that this study has only begun, that a great deal more work is to follow. They have laid out for themselves a number of areas. At least, they must concern themselves with the relationship between this type of disorder and the personality conflicts and defenses. This particular study, I am sure, is anticipated, and the authors expect to follow what they have begun.

This, at first glance, appears to precipitate us into a syndrome which, on a physiologic basis, manifests itself in psychiatric symptoms indistinguishable from the anxiety symptoms of its "functional" disorders. If that is so, the authors have suggested a broad field for detailed investigation.

Then, there is the causal relationship between alcoholism and pancreatic disorders. There is suggested here, possibly, the missing physiologic link between the dependent, immature personality who does not become alcoholic, and that personality with almost the same characteristics who does become alcoholic.

We would be making a grave error to overlook the fact that the X factor in the choice of expression of symptomatology may lie in the soma rather than in the psyche. To deny that possibility would be to deny our own concept of an indistinguishability between those two parts of the total person.

It seems to me, also, most appropriate that this paper should follow immediately the report of Dr. Gerty's committee on the problem of licensing clinical psychologists. In the practice of medicine, when any medical technique is turned over to nonmedical personnel for administration, it is assumed that this technique has been refined to its ultimate.

Obviously, psychotherapy and the management of patients with psychiatric symptoms have not reached that stage of definition. Psychotherapy and the management of the mentally ill is not yet in the category of a psychosomatic administration, to be handed to those less well-trained than a qualified psychiatrist.

Again, this points out to me the consideration of including psychiatric illness in our medical-practice acts, bringing our legal status up to our scientific knowledge. More than anything else, I think, this paper serves to point out that psychiatry is a medical specialty, and must be practiced in a medical setting.

Thank you.

DR. NOBLE (Closing):

Mr. Chairman, Ladies and Gentlemen: The discussants have brought out many aspects of the unfinished business connected with our work. We are dealing with a large problem which is nuclear to the whole understanding of anxiety. So far, we have very little to say but a great deal to do.

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Two or three things occurred to me, from the observations of the discussants. One was the fact that in psychiatric work, as in all medical work, we run into snags with problems in which there are close similarities, or in which two illnesses or two syndromes appear to co-exist.

For instance, in some of our patients, we found there was a definite history of emotional difficulties which beclouded the diagnostic problems.

Whether these emotional difficulties could be considered as an expression of some somatic anxiety and, in that sense, were a part of a total picture, or whether they were entirely independent, is a problem for speculation.

A second matter of importance was that in our study of patients with delirium tremens, contrary to our original expectation, we found a striking absence of pancreatic disease. We had the idea that many of these people would show some latent pancreatic disease which would turn out to be an important contributing element to the production of toxic psychosis. This has proven to be untrue.

Therefore, the question arises as to why it is that in some patients, alcohol, when it is ingested, affects the pancreas and in others the central nervous system. This, again, is a problem which requires investigation.

We are grateful to the discussants for their helpful suggestions in our work.

#### BIBLIOGRAPHY

1. BEAZELL, J. M. AND IVY, A. C.: Alcohol and the digestive tract, *Quart. J. Stud. on Alcohol.* 1:45-73 (June) 1940.
2. CLARK, E.: Pancreatitis in acute and chronic alcoholism, *Am. J. Digest. Dis.* 9:428-31 (Dec.) 1942.
3. COMFORT, M. W., GAMBILL, E. E. AND BAGGENSTOSS, A. H.: Chronic relapsing pancreatitis, *Gastroenterology* 6:239-85 (April) 1946.
4. DOMZALSKI, C. A. AND WEDGE, B. M.: Effects of serum amylase, *Am J. Clin. Path.* 18:43-47 (Jan.) 1948.
5. RICKLES, N. K.: Functional symptoms as first evidences of pancreatic disease, *J. Nerv. & Ment. Dis.* 101:566-71 (June) 1948.
6. ULETT, G. AND PARSONS, E. H.: Psychiatric aspects of carcinoma of the pancreas, *J. Missouri M. A.* 45:490-93 (July) 1948.
7. WEINER, H. A. AND TENNANT, R.: A statistical study of acute haemorrhagic pancreatitis, *Am. J. M. Sc.* 196:167-76 (Aug.) 1938.
8. WILLIAMS, R. D.: Chronic pancreatitis, *Am. J. Med* 7:137-44 (July-Dec.) 1949.
9. YASKIN, J. C.: Nervous symptoms as earliest manifestations of carcinoma of the pancreas, *J.A.M.A.* 96:1664-68 (May 16) 1931.

# Evaluation of Carbon Dioxide Therapy of the Neuroses\*

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The original work with carbon dioxide therapy in psychiatric conditions was performed by Loevenhart, Lorenz and Waters,<sup>1</sup> whose work with psychotics in 1929 showed that 30 to 40 per cent carbon dioxide in oxygen inhalations made catatonic patients respond with mental clarity for short periods of time. In 1948, Dr. L. J. Meduna published his "Alterations of Neurotic Pattern by Use of Carbon Dioxide Inhalation,"<sup>2</sup> the most complete single paper he has written on the subject, the first of several earlier papers having been published in 1947.<sup>3</sup> These were followed by the publication of his book, *Carbon Dioxide Therapy*,<sup>4</sup> the most comprehensive available work on the subject. In 1947, the senior author of this paper observed the work being done by Meduna at the Neuropsychiatric Institute of the University of Illinois, in Chicago, and since early 1948 has himself treated 100 patients with carbon dioxide therapy.

The object of this paper is to make a critical evaluation of carbon dioxide therapy of the neuroses, an evaluation from the point of view of its effectiveness, the longevity of its effects, the dynamics of its action on the brain, and the safety of administering it, also taking into account, through the use of controls, the possible effects of suggestion.

For the purposes of this paper, 25 cases have been evaluated. Of these, 10 were treated by the senior author, 10 had been treated previously by L. J. Meduna;† 5 were "treated" by us as a control group. These groups will be referred to respectively as the New Group, the Old Group, and the Control Group. The latter included only men; each of the other two groups included 3 women. The age of the patients varied from 21 to 42, the average age being 29.8 years. Each of the patients was evaluated by a clinical psychiatric examination, through the use of the partial Halstead battery consisting of the Halstead flicker fusion test, the Halstead finger oscillation test, the Halstead time sense test, and, finally, the Rorschach test. Both psychiatric examination and tests were given before therapy was begun\*\* and were repeated 10 days after the thirteenth treatment had been given to patients in the New and Control Groups. The Old Group had been clinically evaluated and given the Rorschach both immediately before and immediately after treatment; they

\*Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the policy of the Veterans Administration.

†Material and cases for the Old Group were made available to us through the kind permission of Dr. L. J. Meduna, Professor of Psychiatry, University of Illinois.

\*\*We wish to express our gratitude to Dr. W. Halstead for his advice and help in the performance of these tests.

were clinically evaluated and given the partial Halstead battery at the time of our investigation.

In selecting our cases, we required only that all patients be between 20 and 45 years of age, properly diagnosed as having a fundamentally neurotic reaction, and in good physical health, especially as to their neurologic condition and the condition of their eyes. Thirty treatments was set up as a standard number for the New Group. This number was decided upon because previous clinical experience had shown that if changes were going to occur they would begin to do so at about the time 30 treatments had been given. Four members of the New Group had treatment continued after their tests following their initial 30 treatments; these four showed consistent improvement. The Control Group of 5 patients were given inhalations of air to which had been added small spurts of carbon dioxide in amounts insufficient to cause any therapeutic concentration of carbon dioxide but sufficient to make the group think that they were receiving the same treatment as the other patients. Otherwise, suggestion was kept to an absolute minimum. It is recognized that the treatment situation itself had suggestive value, but no specific psychotherapy was used other than the gas treatment.

The carbon dioxide itself was administered by placing a direct-pressure contour mask on the face of the patient, who was instructed to breathe regularly and deeply. Before the mask was placed on the patient's face, a flow of gas consisting of 30 per cent carbon dioxide and 70 per cent oxygen, maintained at room temperature, was started; this flow was kept under two pounds' pressure. Treatment was given 3 times a week — every other day during the work week. At each treatment unconsciousness was achieved. Treatment took about 2 minutes, recovery, about 5 to 10 minutes. The patient returned to work immediately.

Classification of the 3 groups of patients participating in the project is given in Table 1. It should be noted that the majority of cases were diagnosed primarily as anxiety reactions, but also that, although anxiety was outstanding, practically all of the patients had somatic reactions, and that, in some cases, additional diagnoses were made. The method of diagnosis that was adopted was primarily descriptive, as it was felt that this type of classification most accurately showed the type of patients treated. The method of classifying the frequency and intensity of clinical symptoms is given in Table 2. Tables 3, 4, and

TABLE 2

<i>Frequency of Symptoms</i>		<i>Intensity of Symptoms</i>	
0 Absent	None	A (0) None	
1 Infrequent	Between moderately frequent and absent	B (1) Minimal (existing to minor degree, but still present)	
2 Moderately frequent	About half the time	C (2) Moderate, half between severe and none	
3 Very frequent	Somewhere between moderately frequent and constant	D (3) Severe (greatest intensity possible for individual and situation)	
4 Constant	Always		

## EVALUATION OF CARBON DIOXIDE THERAPY

TABLE 1

### *New Cases*

1. Anxiety reaction, chronic, severe, with schizoid tendencies, tension, anxiety, fear of making decisions necessary for interpersonal relationships, and sadistic phantasies.
2. Anxiety reaction with somatization reactions, chronic, severe, manifested by tension, irritability, anxiety, tremulousness, cephalgia, hyperhidrosis and startle reaction; alcoholism, chronic, severe.
3. Anxiety reaction, chronic, severe, with somatic reaction of hyperhidrosis plus stammer since age of 9, with tension and anxiety.
4. Anxiety reaction with conversion and somatization symptoms, chronic, severe, with tension, anxiety, diarrhea, peculiar feelings in abdomen, weakness, dizziness.
5. Anxiety reaction, chronic, severe, with cephalgia, dizzy spells, attacks of diarrhea, obsessive ideation, and tension.
6. Anxiety reaction, chronic, severe, with tension, anxiety, depression, and blushing; paranoid personality reaction.
7. Conversion reaction, chronic, moderate, with attacks of numbness of upper extremities and acute weakness, generalized.
8. Anxiety reaction, chronic, severe, with cephalgia and generalized aches and pains, tension and anxiety; schizoid personality.
9. Anxiety reaction, chronic, severe, with tension, anxiety, tremulousness, colitis, and diarrhea.
10. Anxiety with conversion symptoms, chronic, severe, with tension, anxiety, peculiar painful feelings in head which incapacitate, depression, insomnia, and agitation.

### *Old Cases*

1. Anxiety reaction, chronic, severe, with tension, anxiety, stammer and stutter, difficulty in interpersonal relationships, strong homosexual tendencies and guilt feelings.
2. Anxiety reaction, chronic, severe, with tension, anxiety, and sex difficulties; inadequate personality reaction.
3. Anxiety reaction, chronic, moderate, with anxiety, suicidal feelings, stammer and stutter; schizoid personality.
4. Anxiety reaction, chronic, moderate, with tension, anxiety, stammer and stutter.
5. Anxiety reaction with conversion symptoms, chronic, severe, with tension, anxiety, trismus, spasms of throat.
6. Anxiety reaction, chronic, severe, with tension, anxiety, bashfulness, emotional instability, and severe stutter and stammer.
7. Anxiety reaction, chronic, severe, with conversion symptoms, of cephalgia, insomnia, frigidity and generalized aching.
8. Anxiety reaction, chronic, moderate, with anxiety, tension, stutter and stammer, tachycardia and easy excitability.
9. Anxiety reaction with somatization, chronic, severe, with stutter, stammer, irritability, anxiety, tension, vomiting, insomnia, neurodermatitis, hyperhidrosis.
10. Anxiety reaction, chronic, severe, with tension, anxiety, constipation, hyperhidrosis, sexual difficulties; emotional instability reaction.

### *Controls*

1. Anxiety reaction, chronic, severe, with obsessive fear of death, being alone, going insane, tension, apprehension, emotional instability.
2. Anxiety reaction, chronic, severe, with somatization reaction, manifested by anxiety, tension, restlessness, irritability, cephalgia, backache, tremulousness, hyperhidrosis, syncope and inability to work.
3. Conversion reaction, chronic, moderate, with referral of pains in back.
4. Conversion reaction, chronic, severe, with daily headaches and weakness of knees.
5. Psychogenic somatization reaction, chronic, moderate, with pains in back of knees, nausea, and vomiting; emotional instability reaction.



5 outline the types of clinical symptoms found in the cases treated and the frequency and intensity of each symptom for each case before and after treatment. At the bottom of each column the numerical symptom summary is given, before and after treatment, if one substitutes 0 for A, 1 for B, 2 for C, and 3 for D. This numerical symptom summary is given in order to make it possible to summarize completely on a numerical basis the symptoms before and after treatment in each case. The symptoms listed are those found in our cases, not all possible neurotic symptoms. Table 6 provides a summary of age, sex, number of treatments, number of inhalations of carbon dioxide per treatment, date on which treatment was terminated, time which elapsed before the patient was again tested, and a numerical symptom summary before and after treatment for each patient.

#### • EFFECTIVENESS OF THERAPY

The numerical symptom summary speaks for itself. It shows improvement in 9 out of 10 of the New Cases. The only patient who did not improve was a severe, chronic alcoholic who reported for treatment irregularly. Eight of the 10 cases showed marked improvement in their condition, and 1 showed mild improvement.

Of the Old Group, 7 showed marked improvement in their condition, 2 showed moderate improvement, and 1 showed minimal improvement. In other words, all of the Old Group showed some improvement. The length of time that this improvement was maintained can be seen quickly by referring to the column in Table 6 which shows how much time elapsed between the discontinuance of treatment and the testing of each patient. In the Control Group, none showed any real improvement, and one, because of deterioration in his family relationships, actually became slightly worse. The other 90 cases, treated by the senior author in the last 2 years, have shown approximately the same degree of improvement as the 10 New Cases.

Clinical neurologic examination after treatment showed no organic changes either in the New or Old Group or in the Controls. The Halstead critical flicker fusion test (CFF), carefully performed under basic conditions, showed no significant variation between the results found before and after treatment when performed according to the method (except for method of scoring) of Ward Halstead as described in his manual *Brain and Intelligence*.<sup>5</sup> The Halstead finger oscillation test and the Halstead time sense test (vision), as well as the time sense test (memory), disclosed no significant variation in the New Case series, the Old Case series, or the Control Case series. Not only was there no significant variation between pre-treatment and post-treatment results in the individual cases, but there was no significant variation between the New Cases, the Old Cases, and the Control Cases as groups. The CFF test was performed with a type 631-B General Radio Strobotac as a source of variably intermittent light. The intensity of the light was maintained at a constant for each test. The low-level critical fusion frequency of the subject was made in 10 trials; a run of 5 consistent figures was regarded as critical. Ward Halstead scored the last 5 of 10 trials. The Halstead finger oscillation test, made under basic conditions, was performed by patients oscillating the extended index finger of the dominant hand to





TABLE 4

Symptoms	Old Cases									
	1	2	3	4	5	6	7	8	9	10
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. Involuntary movements	3C 0A	2C 0A	4D 4D	2C 2C	3C 0A	4D 1B			3C 0A	4D 1B
2. Speech difficulties	4D 2B	2C 0A			3B 1B	4D 1B		4D 3C	3C 0A	2B 0A
3. G-I disturbances					4D 0A	4D 1B			4D 1B	
4. Vasomotor disturbances		4D 4D	4D 3C		4D 0A				2C 1B	3D 2B
5. Skin disturbances							3C 0A		2C 1B	2C 1B
6. Respiratory disturbances							3C 0A		2C 1B	2C 1B
7. Cardiac disturbances					3C 0A		4D 0A		3C 0A	3C 0A
8. General aches and pains										
9. Blackout							4D 1B			4D 1B
10. Cephalgia	3C 0A					3C 1B	4D 0A			
11. Dizzy spells and light-headedness										
12. Anesthesias										
13. Other somatic disturbances								2C 2C	3C 1B	4D 2C
14. Irritability, restlessness, and tension	4D 2B	4D 4D	3C 3C	3C 0A	4D 1B	3C 1B	4D 0A		4D 1B	4D 2C
15. Depression	3C 1B	4D 3C	3C 3C		3C 1B		4D 0A		4D 0A	4D 2C
16. Anxiety	4D 2B	4D 3C	3C 3C	3C 0A	4D 1B	4D 0A	4D 0A	3C 2C	4D 1B	4D 2C
17. Intra-psychic protrusions	4D 2B	3C 3C			3C 1B			3C 3C		4D 1B
18. Neurotic dependencies									4D 0A	
19. Concentration difficulties		2C 2C	3C 3C		3C 0A		4D 1B		3C 0A	3C 1B
20. Fatigability		3C 3C					4D 1B		4D 1B	3C 1B
21. Rigidity in thought processes					3C 1B	3C 1B				
22. Sleeping difficulties	3C 1B	3C 3C			4D 0A	3C 1B	4D 1B		4D 1B	3C 0A
23. Dreams and nightmares	4D 1B	3C 3C	3C 2B		4D 1B	3C 0A	4D 0A		4D 0A	4D 1B
24. Somnambulism		2C 2C								
25. Lack of control over impulsive tendencies	4D 2B	3C 3C	3C 2B		4D 1B					4D 1B
26. Nail biting					3C 0A		4D 1B		3C 0A	
27. Anorexia					3C 0A					
28. Enuresis										
29. Menstrual difficulties		4D 0A			4D 0A		4D 0A			2B 0A
30. Physical developmental difficulty		4C 0A			2B 0A					4D 2C
31. Sexual difficulties	4D 2C	4D 4D	4D 3C	3C 0A	4D 1B	4D 0A	4D 3D	3C 3C	4D 1B	4D 3C
32. Family relationship difficulties		4D 4D	4D 3D		4D 0A	4D 1B	4D 1B		3C 1B	3C 1B
33. Decrease of social participation		3C 3C	4D 3D	2B 0A	4D 0A	4D 1B	4D 1B	4D 3D	3C 0A	4D 2C
34. Difficulty in social participation		3C 1B	4D 3D	2B 0A	4D 0A	4D 1B	4D 1B	3C 3C	4D 1B	2C 1B
35. Inferiority feelings	3D 1B	4D 3D	4D 3D	2B 0A	4D 0A	4D 1B	4D 1B	4D 1B	4D 0A	3C 0A
36. Employment difficulties			3C 3C		3C 0A					

totals if A=0 B=1 C=2 D=3

## EVALUATION OF CARBON DIOXIDE THERAPY

TABLE 5  
Controls

Symptoms	1		2		3		4		5	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. Involuntary movements			3D	3D						
2. Speech difficulties										
3. G-I disturbances			3C	3C			3C	3C	3C	3C
4. Vasomotor disturbances			3C	3C						
5. Skin disturbances	1B	1B	3C	3C	3C	3C	2B	2B		
6. Respiratory disturbances	3C	3C	3C	2C						
7. Cardiac disturbances	3C	3C	3C	3C						
8. General aches and pains			3C	3C	3C	3C			3C	3C
9. Blackout			2C	2C						
10. Cephalgia			4D	3D			3C	2B		
11. Dizzy spells and light-headedness	3C	3C	3C	2C						
12. Anesthesias					3C	3C			3C	3C
13. Other somatic disturbances			4D	4D	3C	3C	4D	4D	4D	4D
14. Irritability, restlessness, and tension	4D	4D	4D	4D						
15. Depression	3D	3D								
16. Anxiety	4D	4D	4D	4D			3C	3C	3C	2B
17. Intra-psychic protrusions	4D	4D					1B	1B		
18. Neurotic dependencies	4D	4D	4C	4C			4D	4D	4D	4D
19. Concentration difficulties	3C	3C	4D	4D						
20. Fatigability	2D	2D	4D	4D			4D	4D	4D	4D
21. Rigidity in thought processes										
22. Sleeping difficulties	4D	4D	3D	3D						
23. Dreams and nightmares	4D	4D	3D	3D						
24. Somnambulism										
25. Lack of control over impulsive tendencies	4D	4D								
26. Nail biting										
27. Anorexia	3C	3D	4C	4C						
28. Enuresis										
29. Menstrual difficulties										
30. Physical developmental difficulty										
31. Sexual difficulties										
32. Family relationship difficulties	3C	4D								
33. Decrease of social participation	3D	3D					3C	3C		
34. Difficulty in social participation	3D	3D	2C	2C						
35. Inferiority feelings			4C	4C						
36. Employment difficulties	4D	4D	4D	4D					4D	4D
Totals if A=0 B=1 C=2 D=3	166	175	182	178	24	24	63	59	72	68

activate the lever arm of a mechanical counter at maximum rate. Five trials were given and then averaged. The Halstead time sense test (vision) was made under basic conditions by having the patient estimate ten-second intervals by starting and stopping an electric clock. Memory tests were interspersed with visual trials in the sequence of VVMVMV. Forty visual trials were given in groups of ten. The score was the average deviation from 10 seconds. The Halstead time sense test (memory) comprised 20 trials of the Halstead time sense test (vision) performed without the aid of vision. The average deviation from 10 seconds was the basis of scoring.

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The Old Cases were tested long after treatment had ceased; and, as the patients had not had the partial Halstead battery before treatment, we compared the results of their tests to the standard. To develop a standard for our CFF machine, 50 "normal" volunteers were tested for the CFF. The standards for the other tests were taken from the results prepared by Halstead.<sup>5</sup> Between the standards and results from the Old Cases there was no significant variation.

#### RORSCHACH TESTS

The Rorschach tests were ranked by two independent raters with a significant correlation of  $+.63$ . The raters knew nothing about the nature of the therapy given. Ranking was based upon the amount of change between the pre- and post-therapy tests. Such an inspection is in no way equivalent to a careful analysis of each protocol with an exploration and comparison of the dynamics exhibited in the individual record. It has been pointed out in previous studies that the various factors which give the Rorschach test its clinical value are frequently lost in group or statistical handling. Thus, the increased use of the W location in case A may mean increased ability to organize, more efficient use of intellectual ability, and better perspective. In Case B, a decrease of the W factor may indicate improvement, for B may have abandoned inferior W's for a more realistic perception of his environment. This may be one of the chief reasons why the judgment of Rorschach interpreters showed no agreement with the clinical evaluation of progress (correlation,  $-.14$ ).

Other possible reasons for this lack of agreement should certainly be given consideration: (1) the Rorschach may not be a suitable instrument for effectively measuring such changes; (2) Rorschach inspection may not be effective, and more careful analysis of each protocol may be necessary; (3) changes at the overt or behavioral level in the patient may not indicate changes at a deeper level; or, (4) the loss of symptoms may occur and be observable by both the patient and others before real organizational integration at a deeper level has occurred. Thus the subject does not exhibit these changes in his perception of the stimulus cards. It is also possible that such changes take place at different levels and in different sequence in individuals. The latter hypothesis was offered by one of the Rorschach interpreters after the "blind" inspection with no knowledge of the subject, e.g., as to whether he was "normal" or "abnormal." This interpreter reported that many of the subjects appeared to be in a state of flux, that is, they were gradually relinquishing some of their previous modes of perception. But perceptual habits of years standing are not easily abandoned; there is an understandable reluctance to relinquish them until new modes are tried out. Moreover, when the individual is confronted with an unstructured stimulus he may be even more inclined to rely upon his habitual systems. Does some such explanation of this state of flux account for the negative correlation between the clinical judgment of change and the Rorschach judgment? The question cannot be answered at present.

Previous studies, of which there are too few, show considerable continuity in develop-

mental and personality changes; on the other hand, marked changes are indicated by severe disturbance. In our study, we noted a marked decrease in the W or whole concept between pre- and post-therapy Rorschach testing. Generally, the W response signifies that the individual has the capacity to combine the many aspects of his environment into a meaningful whole. In other words, he has the capacity of integration. It should, however, be kept in mind, as was indicated earlier, that a large number, but very poor type, of W responses could signify a very loose or unrealistic perception of the world. Several interpretations of this finding can be made, but it will probably remain for future research to verify any of them. On the basis of previous studies with the Rorschach, it has been observed that where brain changes have taken place, apparently as a result of organic change, there is a loss of W concept. Thus the existence of this condition in the Rorschach leaves the question of brain changes open to possibility. On the other hand, because of the individual variability of our group, a W decrease was considered to be a sign of improvement for some patients. This was especially true of one patient who had a loss of 16 W responses. Before receiving treatment, this patient had had a quite unrealistic approach; on the post-therapy Rorschach he eliminated many of his poorly-organized W responses in favor of a more concrete and realistic approach, and, since his treatment, has made — as he had been unable to do before — an excellent social and work adjustment.

A summary of the Rorschachs in all of the treated cases revealed decided improvement in 7 of the group, slight or questionable improvement in 5, "no change" in 4, and regression in 4 cases. No specific pattern of change was shown. The Controls showed neither improvement nor regression.

The Rorschach revealed, in general, that many of the treated patients appeared to be in a state of flux, gradually relinquishing some of their previous modes of perception but not as yet having fully established new and more efficient approaches to life situations. The most significant trend was a pronounced decrease in the W response, a decrease which occurred in 11 cases.

#### HOW THE TREATMENT WORKS

At present we have no absolute knowledge of the manner in which carbon dioxide inhalation therapy works in the neuroses. But, however it may work, it certainly does not achieve its effects by choking the patient, as certain newspaper reports seem to think. Leake and Waters<sup>6</sup> state that anesthesia with 30 to 40 per cent carbon dioxide is not due to asphyxia, because only in concentrations of over 80 per cent carbon dioxide could they find evidence of anoxemia. Brown<sup>7</sup> and Gellhorn<sup>8, 9</sup> are of the same opinion. Gellhorn states: "The effects of anoxemia can be alleviated by breathing an increased concentration of carbon dioxide." It is Gellhorn's contention that this alleviation is due to the specific effects of carbon dioxide in increasing respiratory volume, shifting the oxygen dissociation curve to the right, and improving venous return by increasing muscular tonus, and that this alleviation is due to the specific effect of carbon dioxide on the blood vessels of the brain. It is the authors' belief that the rapid breathing which appears immediately

after treatment is due not to anoxemia but to overstimulation of the respiratory centers by the high carbon dioxide concentration in the blood.

EEG's were of no help in this study. With a 30 per cent carbon dioxide and 70 per cent oxygen mixture the patient would show 3 to 4 per second high voltage activity in electroencephalograms, usually at about 18 to 19 respirations. This activity would continue for 20 to 25 seconds beyond the termination of treatment, when the activity would slowly revert to its former status.<sup>4</sup>

The theory which Dr. L. J. Meduna<sup>4</sup> offers in explanation of the effect of carbon dioxide is that the gas permanently increases the threshold of stimulation of the elements in reverberating circuits of the brain (the basic theory of reverberating circuits was proposed by L. Kubie) and thus achieves homeostasis by turning positive feed-back circuits into negative circuits.

On the basis of our own clinical experience, however, with cases treated by carbon dioxide, as well as with those treated by lobotomy, there grew in the senior author's mind the hypothesis that the similarity of effects produced by carbon dioxide and those produced by ablation of the frontal cortex had a common organic origin. The most outstanding clinical changes in our patients was the decrease of affect. Even when the decrease of other clinical symptoms was minimal, affect, especially anxiety, usually decreased markedly. There was a pronounced similarity between the results found on CFF tests of our cases treated with carbon dioxide and those found by the Columbia Greystone Associates<sup>10</sup> in cases treated with frontal lobotomy. They state, "There was no regular association between CFF changes and other psychological or physiological variables at our disposal." In the lobotomy cases which they studied, CFF changes were not related to any of the biochemical, hematologic, or electroencephalographic changes. These changes failed to correlate with any of the scores on other psychologic tests before operation; the changes in CFF following operation were not regularly or consistently related to changes which occurred in other psychologic tests. The Columbia group did not find a decreased intra-individual variability in critical flicker fusion, as had been reported by Halstead, nor did we in our cases. In general, lobotomy did not produce any significant alteration in time judgment, nor did it do so in our cases.

In Rorschach testing, no definite pattern of changes emerged; the control patients frequently showed the same type of changes as those observed in the operated group. The most profound changes were found to occur in reaction time, and, in this respect, the patients that the Columbia Greystone Associate group studied showed a greater decline than was observed in our Control Group. In other factors, no statistically significant findings emerged. Some trends, however, were noted. The factors which showed a tendency to decrease in the operated group after operation were W, R, M, m, k, and FK. The factors that tended to increase after operation were W\* and F—; those that tended to decrease were the ones primarily associated with anxiety, ambition, conflict, and introspection. It may be noted that frontal lobotomies and carbon dioxide treatment caused a decrease in W concepts.

The effect of bilateral removal of Brodmann's areas 9, 10, and 46 in patients in whom there was free verbal expression of anxiety and complaints of mental trouble resulted in a decrease in both the anxiety and the complaints; this decrease was associated with social improvement or recovery from mental illness. Similar results in psychosurgery cases were noted by Greenblatt, Myerson<sup>11</sup> and Catell.<sup>12</sup> The change is one of affective stabilization resulting in the loss of psychomotor tension, painful preoccupation, and self-centered concern with past or present personal problems, thus allowing the patient to react more readily to his environment. We found that practically all of our treated patients had experienced this loss of psychomotor tension and painful preoccupation. In a situation of stress they were better able to handle personality resources and thus were able to cope with their anxiety more effectively than they had been able to previously. They had better conscious, rational control. Neither their intelligence nor their emotional character was impaired. It is our impression that when we use carbon dioxide we are using a method of treatment which causes effects very similar to those produced by lobotomy of the frontal lobes but which, because it has to be repeated a number of times to get the desired results, is fundamentally much more easily controlled than an actual surgical approach.

Our hypothesis, while it appears to be quite different from Meduna's, is really not at all antagonistic to his and could be integrated with his theory. How could one increase the threshold of stimulation in reverberating circuits and thus achieve homeostasis more permanently than by producing actual organic changes, which, in addition to the physiologic changes, might occur as a result of carbon dioxide therapy? In any event, the similarity between the lack of positive findings in psychologic tests of lobotomized cases and the absence of such findings in carbon-dioxide-treated cases—except for the decrease of *W* concepts—plus the similarity in the decrease of anxiety, self-concern, and self-preoccupation and in the increase of behavior directed outward and social adjustment, are remarkable. Indeed, so remarkable are they that they would seem to justify the formulation of the hypothesis that carbon dioxide therapy is effective in a way similar to lobotomy, namely, by causing organic changes of some sort, probably in the frontal lobes and possibly also in other parts of the brain.

#### HOW PROLONGED IS THE EFFECT OF THE TREATMENT?

In view of the fact that the treatment of neuroses by carbon dioxide therapy is relatively new, this question is as yet impossible to answer definitely. There is sufficient evidence, however, to give us at least an idea as to the permanence of the effect. In the 10 Old Cases, evaluations were made of a group of patients whose treatment had been discontinued for from 2 to 29 months. In studying Table 6, one can see that half of these cases had been treated more than two years previously; the results after two years, as shown in the numerical symptom summary, were excellent. The facts speak for themselves. Table 6 adequately covers the question.



TABLE 6

	No.	Age	Sex	Number of Treat- ments	Number of Inhala- tions Per Treat- ment	Date Treatment Stopped	How Much Later Tested	Numerical Symptoms Summary	
								Pre- Treatment	Post- Treatment
New Cases	1.	30	M	30	30	Sept. 1950	10 days	154	32
	2.	33	M	30	30	Aug. 1950	10 days	171	171
	3.	33	M	30	30	Aug. 1950	10 days	94	76
	4.	41	M	30	30	Aug. 1950	10 days	126	72
	5.	34	F	30	30	Sept. 1950	10 days	172	14
	6.	36	F	30	30	Aug. 1950	10 days	165	76
	7.	27	M	11	30	Sept. 1950	10 days	80	7
	8.	25	M	30	30	June 1950	10 days	79	17
	9.	36	M	30	40	June 1950	10 days	133	49
	10.	35	F	30	30	Oct. 1950	10 days	234	37
Old Cases	1.	21	M	50	45	May 1950	2 months	115	18
	2.	26	F	58	35	March 1949	18 months	158	114
	3.	21	M	35	30	July 1948	25 months	117	88
	4.	31	M	31	35	April 1948	29 months	26	4
	5.	25	F	32	30	Aug. 1948	25 months	236	10
	6.	21	M	30	30	Feb. 1948	27 months	102	8
	7.	27	F	79	35	Nov. 1949	10 months	204	17
	8.	23	M	35	30	June 1949	15 months	52	41
	9.	29	M	31	35	March 1949	18 months	174	10
	10.	37	M	300	35	July 1948	25 months	193	39
Control	1.	29	M	30	30	Aug. 1950	10 days	166	175
	2.	28	M	30	30	July 1950	10 days	182	178
	3.	32	M	30	30	June 1950	10 days	24	24
	4.	24	M	7	30	June 1950	10 days	63	59
	5.	42	M	30	30	Oct. 1950	10 days	72	68

## HOW SAFE IS CARBON DIOXIDE THERAPY?

As has been indicated, the senior author has treated 100 patients, administering over 4,000 treatments. The following complications were the only ones encountered: 6 enureses, occurring at the beginning of treatment in patients who, under the stress of treatment, emptied their bladders, not having done so before taking the treatment; 4 mild convulsions which were easily handled on an outpatient basis and which necessitated no post-treatment (one of these convulsions occurred when the patient had had only five inhalations; three of them occurred when the patients had each had over 35 inhalations); and six slight lacerations on the edge of the lips or buccal membranes. The only serious complication reported occurred was in the case of a chronic alcoholic, reported by Meduna, who developed what appeared to be subcutaneous hemorrhages, but who recovered from these without great difficulty. Meduna also reported a few cases of convulsion occurring during treatment and a few cases of enuresis. Taking everything into consideration—the number of treatments, the number of complications that have occurred, and the seriousness of these complications—one can only conclude that the procedure is a safe one.



## EVALUATION OF CARBON DIOXIDE THERAPY

Of special interest is case 10 of the Old Cases, who, over a period of approximately two years, had 300 treatments with no complications, no neurologic findings, and no Rorschach changes of any value, but who did show considerable clinical improvement.

### CONCLUSION

The treatment of the neuroses by means of carbon dioxide inhalation is an extremely effective one. Its effect appears to be prolonged, and it is a safe procedure. The precise manner in which it works is still not known, but this study advances the hypothesis that carbon dioxide therapy of the neuroses operates in much the same way as does a chemical frontal lobotomy.

### RESUME

Des traitements par la thérapeutique à l'anhydride carbonique ont été appliqués à 25 sujets répartis en trois groupes. Les âges de ces sujets s'échelonnaient de 20 à 45 ans; ils jouissaient d'une bonne santé, et avaient été correctement diagnostiqués comme présentant une réaction essentiellement neurotique.

Après un essai clinique mettant en oeuvre la thérapeutique à base d'anhydride carbonique, l'auteur a avancé l'hypothèse que l'analogie entre les phénomènes affectifs produits par l'anhydride carbonique et ceux observés par l'ablation de l'écorce corticale frontale a une origine organique commune.

Le principal changement clinique observé chez les sujets traités a été la diminution des phénomènes affectifs. Ce changement consiste en stabilisation affective qui se traduit par la perte de la tension psychomotrice, une préoccupation pénible, et un souci égocentrique portant sur des problèmes personnels passés ou présents. Ni l'intelligence, ni le caractère émotif de ces sujets n'ont été affectés.

La thérapeutique à l'anhydride carbonique est une méthode de traitement qui produit des effets très analogues à ceux obtenus par la lobotomie des lobes frontaux. Toutes choses étant considérées — le nombre de traitements, le nombre de complications observées, et la gravité de ces complications — on ne peut qu'affirmer que ce mode de traitement est à la fois sûr et efficace.

### RESUMEN

Se llevaron a cabo tratamientos terapéuticos en 25 pacientes divididos en tres grupos. Dichos pacientes tenían a de 20 a 45 años, gozaban de buena salud y habían sido diagnosticados de reacción neurótica.

Después de realizadas las pruebas clínicas empleando la terapia con el anhídrido carbónico, uno de los autores sugirió la hipótesis de que la similitud de los efectos producidos por el anhídrido carbónico y los causados por la ablación del córtex frontal tenían un origen orgánico común.

El cambio clínico más importante en los pacientes fué el decrecimiento de los efectos. Este cambio es una estabilización afectiva resultante en la pérdida de la tensión psicomotora,

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preocupación morbosa y autoconcentración en los problemas personales presentes o pasados. No hubo cambio alguno en la inteligencia ni en el cuadro emocional.

La terapia con el anhídrido carbónico es un método de tratamiento que posee efectos muy similares a aquéllos producidos por la lobotomía frontal. Teniendo en cuenta todo ésto — el número de tratamientos, el número de complicaciones ocurridas y la gravedad de estas complicaciones — solamente se puede decir que el procedimiento es seguro y efectivo.

#### BIBLIOGRAPHY

1. LOEVENHART, A. S., LORENZ, W. F., WATERS, M.: Cerebral stimulation. *J.A.M.A.* 92:880, 1929.
2. MEDUNA, L. J.: Alteration of neurotic pattern by use of CO<sub>2</sub> inhalations. *J. Nerv. & Ment. Dis.* 109:373, 1948.
3. MEDUNA, L. J.: Pharmacodynamic treatment of psychoneuroses. *Dis. Nerv. System* 8:37, 1947.
4. MEDUNA, L. J.: Carbon Dioxide Therapy, Springfield, Illinois, Charles C Thomas, 1950.
5. HALSTEAD, WARD C.: Brain and Intelligence, Chicago, The University of Chicago Press, 1947.
6. LEAKE, C. D., AND WATERS, R. M.: The anaesthetic properties of carbon dioxide. *Anesth. & Analg.* 8:17, 1929.
7. BROWN, E. W.: The physiological effects of high concentration of carbon dioxide. *U.S. Naval Med. Bull.* 28:721, 1930.
8. GELLHORN, E.: Fundamental principles in the adjustment reaction of organism to anoxia. *Ann. Int. Med.* 14:1518, 1941.
9. GELLHORN, E.: Value of carbon dioxide in counteracting oxygen lack. *Nature, London* 137: 700, 1936.
10. COLUMBIA GREYSTONE ASSOCIATES: Selective Partial Ablation of the Frontal Cortex, New York, Paul B. Hoeber Inc., 1949.
11. GREENBLATT, M. AND MYERSON, P. G.: Psychosurgery. *New England J. Med.*, 240:1006, 1949.
12. CATELL, J. P.: A psychodynamic study of topectomy patients. *Am. J. Psychiat.* 107:373, 1950.

# Group Work with Chronic Mental Patients

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Throughout the years, mental hospitals have put their patients to work at some type of hospital industry. The work has ranged from farming to construction gangs and has included labor in gardens, shops, dairies, poultry plants, brick plants, piggeries, laundries and any other hospital occupations where patients could provide some useful service. The therapeutic benefit of such activity was not at first and probably never has been fully considered or evaluated. But as early as 1798, Benjamin Rush, recognizing the deteriorating effect of inactivity, assigned patients to such activities as gardening and cutting corn.<sup>1</sup> He used these merely as a means of taking up the patients' time rather than as therapeutic agents.

The first psychiatric society in America, in 1844, recommended that every hospital for the care of the mentally ill should be located in the country where there was plenty of land for farm work.<sup>2</sup> On the whole, the patients engaging in these activities have been those who in former times were classed "incurable" and who are now referred to as "chronic." According to Ozarin,<sup>3</sup> the patients most suitable for this work have been those with well-preserved personalities, little deterioration and good contact. Simon<sup>4</sup> advised, however, that all patients, with the exception of the physically disqualified, should do regular work. Usually, the work done by patients has proven beneficial to the hospital, sometimes helping in part or in whole to support the hospital or add to its economic resources. Unfortunately, in the past, many patients spent their lives supporting an institution without receiving all the therapeutic benefit that might be derived from this form of activity.

Some psychiatrists have attempted to explain the observation that certain patients improved after being assigned to work about the hospital. As early as 1847, Brigham<sup>5</sup> expressed the belief that manual labor was beneficial because it engaged the patient's attention and directed the mind to new objects of thought. Similarly, 70 years later, Murphy<sup>6</sup> postulated that employment offered a means of teaching the patient to think logically, and thus to readjust himself to the outside world. The redirection of the patient's drive into useful and more acceptable channels was cited as the beneficial effect of this type of activity by Scholten<sup>7</sup> and Grossman.<sup>8</sup> Feeling that natural, refreshing sleep was most important to the patient's recovery, Iles<sup>9</sup> recommended strenuous occupations that took the patient into the open air. Kefauver,<sup>10</sup> specifically recommended agricultural work, because he noted that a large percentage of neuropsychiatric patients in Veterans Administration hospitals had been engaged in farming prior to their admission. Stanley<sup>11</sup>

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thought it important that the work selected for a patient should be a revival of a former occupation in which the patient had done well and which had not been detrimental to him. On the other hand, both Devereux<sup>12</sup> and Inch<sup>13</sup> warned against forcing the patient to return to a former uncongenial or hated occupation.

This brief review of the literature on the value of work for mental patients suggests that only individual factors have been considered in the evaluation of its therapeutic implications. Little attention has been paid to the therapeutic potentialities of a situation in which patients work as members of a group. It is true that the benefits of physical exercise, concentration and redirection of activity cannot be overlooked. At the same time, we know that the prime defect of the mentally ill patient, and particularly of the schizophrenic, is his inability to form object or interpersonal relationships. In group work, the patient "goes places and does things" as a member of a group. As Preston<sup>14</sup> has pointed out, he can progress from an isolated individual working alone beside other people, to a real participant in the group, which, as Anderson<sup>15</sup> has shown, is of value to the patient and to the entire group.

#### DISCUSSION OF GROUP PROGRAM

The Community Ward Project, organized at Winter Veterans Administration Hospital in April, 1948, has been an attempt to create a treatment regime which would integrate the therapeutic potentialities to be derived from active participation in a group with those to be derived from manual labor.

Two adjacent closed wards were set aside for chronic mental patients whose main activity was to be useful group work directed toward goals sufficiently simple and proximate to be meaningful even to chronic mental patients. One ward of 26 patients was specifically organized for the purposes of this project, while the other was merely a regular chronic ward of the Continued Treatment Section which happened to adjoin the specially organized ward. The patients, on the whole, were those who had been in the hospital for long periods of time, and who had been either unsuitable for or else had not responded to other types of therapy. Many had received electroshock or insulin coma treatments, and most had formerly been given some type of individualized milieu therapy in occupational therapy shops.

On each ward there is a large dormitory, a large day room containing chairs and tables, a radio, a good supply of recent newspapers and magazines, and games. The patients are urged to engage in games with each other, and with the psychiatric aides. There is also an adjacent screened porch used by the patients in warm weather. On the grounds between the wards there is a horseshoe-pitching court and space available for sports activities. Each ward is attended by a resident ward physician, a nurse, and a staff of ten psychiatric aides divided among three shifts.

The daily schedule of the two wards is the same. The patients are awakened at 7:00 A.M. and then wash, dress, and shave. They go in a group to the dining hall for breakfast, returning to the ward at about 8:15, and remain on the ward until 9:00, reading, playing

cards, or resting. During this period they are usually seen by the ward physician on his rounds. At 9:00 A.M. the patients of both wards are assigned to work groups and sent into the laundry, the furniture shop, or to an outside detail. The patients are allowed to choose the type of work they prefer.

The laundry detail, composed of about 18 patients from both wards, folds and sorts clothes and helps to arrange garments in the hospital laundry, which also employs non-patient workers. The patients are thus enabled to help launder their own clothes and to work alongside the other workers. They are encouraged to work, and are attended by two psychiatric aides, who engage in similar activities. The furniture shop detail is composed of about 26 patients from both wards who, in the winter months, sand and refinish furniture from their own wards, and also work on other hospital furniture which needs refinishing. They are assisted in this work by four aides from both wards who encourage them and work with them, and by a shop foreman whose full-time job is to instruct the patients and to take care of the shop and its supplies. During the morning and afternoon, coffee is available for the patients, some of whom have even volunteered to take care of the dishes.

During the winter months, the outside detail is composed of about 12 patients from both wards, who request outdoor work. They shovel snow and do winter landscaping around the hospital grounds. In the summer, this detail is considerably enlarged and includes many patients who were in the furniture shop detail in the winter. With the help of four aides, the patients trim trees and shrubbery, paint fences and care for the small flower beds on the hospital grounds. There is also a summer garden detail. This is composed of about 12 patients from both wards who, under the guidance of an aide trained in farming and gardening, care for their own vegetable garden, which produces a good crop of vegetables for use in the patients' kitchen and mess halls.

At 11:00 A.M. they return to the wards, where they rest or enjoy diversional activities in the day room among themselves and with the aides until noon, when they go to the dining hall for lunch. At 1:00 P.M. the patients return to their work details. The period from 3:30 to 6:00 P.M. is spent on the ward and in the dining hall. One hour of the week is spent in the library which, at the scheduled time, is reserved for this group of patients. During the summer months, one hour a day is spent at the swimming pool, where each patient is urged to participate in this activity. Three evenings a week the patients are shown motion pictures and on the other nights there are dances and bingo games for them. Patients on both wards are allowed to go as a group to these events and also to certain special events in town, such as sports programs, fairs, plays and circuses. Saturday mornings, during the summer months, there are picnics in which both wards participate as a group. Other group activities, such as athletic games, are also actively fostered, and in cold weather a gym period is arranged. On Saturday and Sunday afternoons variety shows and recreation periods are scheduled for the groups. Patients may also go to services on Sundays, and to a fellowship hour on Sunday evening.

The ward physician is responsible for the administration of each ward. Both ward

physicians meet weekly with the nurse and psychiatric aides to discuss the patients, their management and their particular problems. Each ward physician, in turn, meets with his supervisor to discuss problems of ward administration, and, in addition, a meeting is held once a week, which is attended by the physicians, the supervisor, representatives of the medical rehabilitation and engineering departments, and the foreman of the furniture shop. At these meetings various projects are discussed and plans for new jobs are formulated. The engineering department supplies the tools for the work, while material is procured through the medical rehabilitation department.

After the inception of this program it was noted that certain criteria were needed for the selection of patients from other wards for treatment on the Community Wards. The type of patient chosen was one who was becoming chronically ill and who had been resistive to various types of individual therapy. Patients receiving active individual therapy were therefore not chosen for this program. It was also noted that in spite of persistent efforts, extremely negativistic patients could not benefit from this program and therefore only patients who had shown some inclination to work on other wards, or who expressed a willingness to work, were chosen. Patients who were elopement risks or who needed special attention or precautionary measures were usually not accepted because they would have required excessive attention from the aides with the result that the rest of the patients would have had to be neglected. More aggressive and combative types of patients were also not chosen because they would have exerted a disruptive influence on group work and activities. Very confused patients were likewise not desired since they are not able to follow simple directions and could not profitably use the freedom which this program provides for patients in the course of their work on the grounds and on trips to town.

#### RESULTS

The ward of the Community Project, organized in April, 1948, admitted a total of 60 patients in the 22-month period ending February, 1950. The average age of all the patients was 41 years; their average period of hospitalization prior to their admission to this ward was three years. As regards the patients who were discharged from this ward, their average period of hospitalization on this ward was seven months. During this time a noticeable improvement took place among the patients. Many, in spite of a previous full activity program, similar to that of Myerson's "Total Push,"<sup>16</sup> had remained untidy, negativistic and unresponsive, with little awareness of their surroundings. After a short time on the Community Ward, where they engaged in group-directed work, these patients became more conscious of their surroundings. They became more tidy, took care to hang their clothes in their individual lockers, asked for ash trays for their cigarettes instead of throwing them on the floor, and no longer spat on the floor. Instead of lying on their beds during leisure hours, as they had done previously, they began to spend their spare time playing games with the aides or other patients, or listened to the radio. It was noted that many patients who for a long period of time had been seclusive and withdrawn, established interpersonal relationships through participation in group-work, and manifested a definite

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identification with the group. Many patients habitually referred to themselves as being part of this special group, and even resented the appearance of unfamiliar personnel not connected with the group. Patients who had previously been quiet and apathetic commented on, and pointed to, work which they had helped to accomplish.

TABLE 1  
*Results by Diagnostic Categories*

	Number Treated	Number to Open Ward, Trial Visit, and Discharged	Number Remaining	Number Transferred and Eloped
Schizophrenia .....	45	12	20	13*
Paranoid .....	24	6	10	8*
Simple .....	5	2	3	—
Hebephrenic .....	9	1	6	2
Catatonic .....	3	—	1	2**
Mixed and unclassified.....	4	3	—	1
Chronic Alcoholism, without psychosis....	5	3	1	1
Organic Brain Disease, with psychosis....	4	3	—	1**
Korsakoff's Syndrome .....	2	1	1	—
General Paresis .....	2	—	2	—
Involuntional Melancholia .....	1	—	1	—
Manic Depressive .....	1	—	1	—
	60	19	26	15

\*Includes two elopements.

\*\*For medical reasons.

The table shows that by far the greatest percentage of the population of the Community Ward described was the schizophrenic group, which constituted 75 per cent of all patients admitted to the ward. Of the total group of 60 chronic patients, seven improved to such a degree that they were sent on trial visit or were discharged from the hospital, and ten other patients made such a favorable adjustment that they were transferred to an open ward for subsequent discharge. Two other patients, who were able to adjust to this group environment, were discharged to a domiciliary home. Thus, 30 per cent of the total number were eventually discharged. Thirteen patients had to be transferred to other wards, two for medical reasons and the other 11 because they had become unmanageable, their combativeness and aggressive behavior becoming a disruptive force in the group-oriented program under consideration. The other patients remaining on the Community Project showed definite improvement proportionate to the time they had been on the ward. This improvement was manifested in their appearance, behavior, socialization, activity, increased ability to concentrate and cooperativeness. They were able to adjust to a level of community environment within the hospital which, it is hoped, could eventually be raised sufficiently to permit the attainment of a similar level of adjustment also extramurally.

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The two brief case-histories about to be presented pertain to patients who are typical of those selected for admission to the Community Project Ward. In addition, these case-histories summarize the treatment and improvement of these patients while on the ward. In both instances it became eventually possible to return the patients to the community at large, by placing them in a supervised environment similar to that which the hospital had previously provided for them.

#### CASE 1

A 29-year old white, unmarried farmer was admitted in April, 1949. During a previous hospitalization in 1943, while he was in the Army, he was given the diagnosis of schizophrenia. After his discharge in 1945, he engaged in much antisocial behavior, drank heavily, and made a poor adjustment as a farm laborer and truck driver. After being arrested in January 1949 for check forgery, he was found to be hallucinating and hyperactive, and was therefore admitted to this hospital. On admission, he was oriented and compliant, but hyperactive and had auditory hallucinations. He was placed on the Community Ward where he engaged seclusively in his former occupation, working in the garden detail. Later on, at his own request, he was transferred to the furniture shop. Gradually he became less arrogant than he had been, and showed more co-operativeness and self-confidence. He soon stopped hallucinating and made many friends in his working group and among the aides. By December, 1949, it was felt that his adjustment had greatly improved since his admission. He had regained interest in himself and desired to attend educational classes so as to advance beyond his fifth-grade education. He was therefore transferred to an open ward, where this could be accomplished. Here he worked hard in classes, continued being a member of the group and was elected president of the ward club. He was eventually allowed to leave the hospital on a trial visit.

#### CASE 2

A 42-year old, white, unmarried laborer was admitted in March, 1948. He had been hospitalized previously in 1942, when his behavior in the Army had become bizarre. At that time he was destructive, hyperactive and hallucinatory. On his discharge from the Army he wandered through the Northwest, working as a machinist and as a shipyard laborer. In February, 1948, he was hospitalized because of his erratic behavior, and he was admitted here in March of the same year. On admission the patient was so agitated, incoherent and antagonistic that it was necessary to maintain him on hydrotherapy, in order to control his hyperactivity. Nitrous oxide treatments and a course of electroshock resulted in little improvement. The patient continued to be seclusive, delusional, unfriendly, irritable, and paranoid, and spent his time writing letters filled with peculiar writing and neologisms. On his transfer to the Community Ward in December, 1948, the patient was assigned to the laundry detail at his own request. After the first five months it was noted that he had become one of the best workers in the laundry and was participating in group activity which he had refused to do at first. He became more friendly and, with his increased interest in working, became less preoccupied with his religious and paranoid delusions and spent less time in writing. By September, 1949, though he still manifested some vague and circumstantial mannerisms of speaking and still showed some religious preoccupation, it was felt that he had attained a level of adjustment which would permit his being placed in a similar supervised environment outside the hospital. It was therefore arranged that he should live with his sister and brother-in-law. While in domiciliary care, the patient first worked as a bowling-pin setter and then, with increased self-confidence, obtained a job as a machinist in his brother-in-law's factory. At the present time the patient is making a good adjustment, and is earning a good living.

## DISCUSSION

It is generally accepted that work can be a useful therapeutic device for restoring mentally ill individuals to a higher level of adjustment. In the first place, work is one of the most necessary of all functions, since it insures survival. It also allows identification with family figures or patterns, the creation of self-esteem and the establishment of a feeling of security. Furthermore, work offers a constructive outlet for aggressions, since it always involves some sort of a destructive element and a striving to master some situation or material. What makes work so important as one of our chief sublimations is that it represents a diversion of man's destructive energies into useful and desirable channels. However, work is a successful sublimation of destructive impulses only if the worker does not feel too frustrated by the monotony and drudgery of his work or by the fact that he is unable to see the connection between his part of the work and the final product of a co-operative undertaking. A further condition of successful sublimation is the worker's awareness of the meaning both of his own work and of the final product thereof. An exception to this is the assigning of unpleasant tasks to patients harassed by excessive guilt feelings, which the performance of unpleasant jobs often alleviates sufficiently to make these patients accessible to other forms of therapy. It must be stressed, however, that in this instance unpleasant work is not to be viewed as *therapy*, but merely as *preparation for therapy*.

When such external conditions<sup>17</sup> as a minimum of compulsion, a comfortable group feeling, lack of discomfort or fatigue, adequate rest and recreation, pride in the product and a knowledge that the work is useful and appreciated are present, work can be pleasurable and thus becomes a complete sublimation.

## SUMMARY

This paper was devoted to a brief discussion of the use of work in the institutional treatment of mental disease. It was noted that such activities had been in vogue for over 150 years and that various explanations of its therapeutic efficacy had been proposed. A description of the Community Project Program at the Winter Veterans Administration Hospital has been presented. No rationale has been offered to explain the observed results, though it was felt that the benefits obtained resulted partly from the close identification which the patients were able to make with the group itself and partly from the benefits of manual labor.

It is felt that such a program, if closely supervised as described, can be of use in shortening the hospitalization of the heretofore "incurable" or chronic mental cases. By means of such a program the patient can be brought to a level of social and work adjustment which enables him to be placed in an environmental situation of a similar level of functioning.

## RESUMEN

Esta comunicación tuvo como finalidad discutir brevemente los trabajos sobre el tratamiento institucional de la enfermedad mental, observándose que tales actividades

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habían estado en boga por más de 150 años y que se habían expuesto varias explicaciones acerca de su eficacia terapéutica. Se presentó una descripción del "Community Project Program" en el Winter Veterans Administration Hospital. No se ha presentado ninguna explicación razonable que justifique los resultados observados, aunque se cree que los beneficios obtenidos resultaron, en parte, de la estrecha identificación que a los pacientes les fué posible hacer con el grupo mismo, y en parte de los beneficios del trabajo manual.

Se estima que tal programa, si se supervisa estrechamente como se ha descrito, puede ser de utilidad para acortar la hospitalización de casos mentales hasta el momento crónicos o "incurables." Por medio de tal programa se puede lograr que el paciente alcance un nivel de adaptación social y de trabajo que le permita colocarse en situación ambiental de un nivel similar.

#### RESUME

Cet article donne un bref exposé de la mise en oeuvre de la thérapeutique par le travail dans le traitement hospitalier de cas mentaux. On y signale, notamment que ce genre d'activité est d'un usage courant depuis plus de 150 ans et que diverses explications de son efficacité thérapeutique ont été avancées. Un exposé du Programme du Projet en Commun entrepris à l'Hôpital d'Anciens Combattants Winter a été présenté. Une analyse raisonnée a été soumise pour expliquer les résultats observés, bien que l'impression ait été que les résultats salutaires obtenus étaient attribuables en partie à l'assimilation étroite que les sujets ont pu accomplir dans le groupe même et en partie aux avantages dérivant du travail manuel.

On estime qu'un programme de ce genre, s'il est contrôlé rigoureusement de la manière décrite, peut être utile pour raccourcir la période d'hospitalisation des cas mentaux chroniques ou des cas jusqu'ici réputés "incurables." Au moyen d'un tel programme de traitement le malade peut être ramené à un niveau d'adaptation social et de travail qui lui permet d'être placé dans une situation ambiante de niveau fonctionnel analogue.

#### BIBLIOGRAPHY

1. WADE, DAVID: Occupational therapy as a component of a unified treatment program in psychiatry, *Occup. Therapy*. 20:167-175 (June) 1941.
2. CHRISTOFFERSON, H. H.: Medical care of the mentally ill in the county asylums of Wisconsin, *Wisconsin M. J.* 43:1229-1234 (May) 1944.
3. OZARIN, L. D.: Consideration of the continued treatment service, *Psychiatric Quart.* 17:347-354 (April) 1943.
4. WERTHAM, FREDERIC: Progress in psychiatry, II; the active work therapy of Dr. Simon, *Arch. Neurol. & Psychiat.* 24:150-160 (July) 1930.
5. BRIGGS, L. V.: Occupational and industrial therapy—how can this important branch of treatment of our mentally ill be extended and improved? *Am. J. of Insan.* 74:459-479 (January) 1918.
6. MURPHY, J. P. N.: The therapeutic use of occupation in the treatment of the insane, *Internat. Clin.* (28th series). 1:139-155, 1918.
7. SCHOLTEN, WILLIAM: Occupational therapy as a preliminary to industrial therapy, *Occup. Therapy*. 21:86-89 (April) 1942.
8. GROSSMAN, MAURICE: A group therapy program in a neuropsychiatric hospital, *Med. Bull. Vet. Adm.* 21:149-170 (October) 1944.

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9. ILES, U. G.: Farm work for mental cases, *U.S. Veterans Bureau Medical Bulletin*, 4:282-285 (March) 1928.
10. KEFAUVER, H. J.: Agriculture as occupational therapy in the neuropsychiatric hospitals, *U.S. Veterans Bureau Medical Bulletin*, 2:592-600 (June) 1926.
11. STANLEY, JOSEPHINE: Habit training, *Occup. Therapy*. 21:82-85 (April) 1942.
12. DEVEREUX, GEORGE: The social structure of the hospital as a factor in total therapy, *Am. J. of Orthopsychiat.* 19:492-500 (July) 1949.
13. INCH, G. F.: Therapeutic placement of mental patients in state hospital industries, *Occup. Therapy*. 15:241-248 (August) 1936.
14. PRESTON, G. N.: Relating occupational therapy to reality, *Occup. Therapy*. 21:17-24 (February) 1942.
15. ANDERSON, C. L.: Project work—an individualized group therapy, *Occup. Therapy*. 15:265-269 (August) 1936.
16. MYERSON, ABRAHAM: Theory and principles of the "total push" method in the treatment of chronic schizophrenia, *Am. J. Psychiat.* 95:1197-1204 (March) 1939.
17. MENNINGER, KARL: *Love Against Hate*, New York, Harcourt, Brace, 1942, Ch. 6.

### REPORT ON THE MEETING OF SEPTEMBER 9, 1951 devoted to the study of GROUP OCCUPATIONAL THERAPY AND ERGOTHERAPIC GROUPS IN PSYCHIATRIC HOSPITALS

On Sunday September 9, in the Psychiatric Hospital of Bonneval, in the presence of Dr. Aujaleu, Executive at the Ministry of Public Health and under the chairmanship of Dr. Henri Ey, there met Drs. Bernard, Ch. Durand, Daumezon, Diatkine, Follin, Koechlin, Leulier, Le Guillant, Lebovici, Preaut, Sivadon and Tosquelles. All these colleagues have a wide experience in organizing occupational therapy departments.

Some of them (Lebovici, Diatkine) are specialists in group psychotherapy in Paris. All were unanimous in finding the work of M.R.A. Solow very interesting in view of the results obtained. These results are approximately the same as those we have obtained in France, taking into account the material and medical means which are undoubtedly much superior to those at the Winter VA Hospital.

The discussion was conducted on the topic of the general problem of social therapy in a psychiatric hospital environment. Due to the fact that there were present at this meeting psychiatrists representing a great variety of activities in the therapeutic field (convalescent homes, psychotherapeutic hospital centers, psychiatric hospitals), each doctor was able to speak of his own experience. In this connection, the socialization undertaken for the last two years or so in an old "home" like that of Saint Alban in the Central Massif, due to the initiative of Dr. Tosquelles, was seen as a particularly significant effort.

Likewise, special interest was attached to the organization of the departments headed by Drs. Sivadon and Le Guillant in Paris, aiming at realizing a greater social reclassification of patients, which departments are subsidized by the Social Security Fund.

Finally, the question was raised and discussed as to whether it would be advisable to create a "real" occupational society and enterprise, either to readjust the patient to the real life and work conditions in real social life, or to give to patients who cannot be readjusted a living environment as close as possible to normal social conditions—or whether it would be preferable to reduce the number of artificial "groups" and to resort to collective psychoanalytic techniques. The discussion led to the conclusion that a social therapy worthy of the name requires these two aspects of therapeutic activity and that it is necessary to resort to group psychotherapy on the psychoanalytic pattern for cases requiring "true" psychotherapy, that is, a substantial modification of psychic life incapable of socialization by ordinary occupational therapy.

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# The Psychological Impact of Atomic Science on Modern Art

## AN EXPERIMENT IN CORRELATION

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### I

#### THE PHILOSOPHICAL BACKGROUND OF THE NEW ATOMIC SCIENCE

##### *A. The new scientific ideology of the twentieth century*

The year 1900 is a decisive date in the history of human thought. In that year there began to appear on the intellectual horizon of the new century a series of new ideas which differ radically from those which formed the philosophical and scientific subsoil of the nineteenth century. Now, half a century later, these new concepts have already become integrated into an ideology peculiar to our time.

Man today is demonstrating the great creative value of ideas. Backed by new theories of physics, he is succeeding in harnessing even the remotest stars in equations formulated by a human brain in the solitude of a laboratory. Just as the Copernican theory was the educating principle of the Modern Age, the ideas of a four-dimensional universe, curvilinear space, and finite spheres, joined to the present-day autonomy of each scientific discipline, mark the historic countenance of our century. Just as the sun sheds different colors on the countryside as it rises, the new ideology of the twentieth century is coloring all human activities, from scientific thought and artistic accomplishment to the humblest routine tasks.

The year 1900 also marks the beginning of an historic crisis in the evolution of scientific thought. It is a date comparable to the year 1300—Dante's hour—when a new conception of the world was born which was to prevail for many generations. One system of scientific convictions has succeeded another, not by continuity but in jumps, which makes the transition even more dramatic.

The crisis in scientific thought, which brought in its wake a crisis in artistic thought, left modern man without a solid universe by upsetting his convictions, isolating him in a vacuum and shattering the ideas which underlay the world of the nineteenth century. But

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thought, like nature, abhors a vacuum, and tends to fill it in immediately with culture patterns, just as the body fills with conjunctive tissue any hollow which occurs in it.

In modern life, science acquires the character of a supreme organ which pumps animating strength into other artistic or philosophic organs, which are more adipose or conjunctive, and less vital than scientific thought. To sketch the lines of modern scientific thought is to trace the framework within which the other forms of contemporary life, especially that plastic creativity we call modern art, can be interpreted.

At the turn of the century it was thought that everything had already been invented: Since 1880 people had been using internal combustion engines, which later made possible the development of automobiles and airplanes; wavelengths had been discovered by Hertz in 1887; the first radiogram had been sent from the Isle of Wight in 1898; the first public telephone had been inaugurated in New Haven, Connecticut, in 1878; the germ theory had been in circulation since 1860. And yet, if a man who had been living for the last half century in suspended animation were to wake up today and look about him, how dumb-founded he would be by the changes which have occurred in the world around him!

Has the universe changed then? No; the universe has not changed throughout the course of history; what has changed is only our mental attitude towards the universe. Life has existed for 1,200 millions of years; man has existed for about a million years; he has made use of his brain for his own progress for 50,000 years; he has been able to record his thoughts for about 6,000 years; but he has been using science as an educational factor for only about 300 years. In the last three centuries, the mission of science has been to draw up for man an inventory of the universe, to reveal to him all available possibilities and how to use these possibilities for his own betterment, or sometimes for his own destruction.

Perhaps no other science has influenced human thought as profoundly as physics. Starting from that historical crisis which we call the Renaissance, physics has tried to uncover the laws which govern material objects in time and space. Only a century ago physics was still subject to the laws of causality which ruled the universe with an iron hand. But the development of mathematics—genius's chosen field—has revolutionized the physics of the twentieth century, thus marking a critical moment in the history of civilization. The new physics has brought forth manifold geniuses, just as the Florentine art of the *Quattrocento* produced a plethora of artists.

The change in our mental attitude towards the universe has signified notable progress for man. This progress is due less to scientific discovery than to the conception of new relationships among various ideas; it has been due more to man's ability to see old physical and mental phenomena through new eyes, following the rule set down by the German mathematician of the last century, Karl Jacobi: *Mann muss immer umkehren* (One must always turn things around).

This new spirit of scientific research has caused the basic concepts underlying the universe up to 1900, such as space and time, inertia, energy and symmetry, to be upset by a demon which has shaken physics, shattered the Aristotelian notion of natural motion



and converted these classic ideas into theories like space-time intervals, the curvature of the universe, and atomic vortices.

*B. Historico-philosophical roots of the new atomic science*

By "atomic science" we understand the new physico-mathematical thought initiated at the beginning of the century, which has supported the most revolutionary changes in the history of human thought.

In the mind of the layman there is usually a close association between the idea of atomic science and its spectacular application in the explosions which marked a supreme advance in the science of killing. But in our study we shall not speak of the atom bomb, which is only a "practical" aspect (what was Dante's *Inferno*, after all, in comparison?) of physico-mathematical thought which has governed the development of atomic energy.

What we are setting out to do here is to sketch the philosophic profile of the principal advances in physical and mathematical thought in the last fifty years, and study its repercussions in other intellectual activities of man in our time.

Man has needed so many years to be able to develop his ideas about the atomic structure of matter because the conceptions of the atom were from the very beginning in apparent contradiction with the testimony of his own senses. Sight and touch tell us always that our body, and everything that surrounds us, is solid and continuous matter. The idea that matter is neither solid nor continuous seems as fantastic to certain people in 1952 as it was in the fifth century B.C. to even the most enlightened, when the Greek philosophers expressed for the first time the theory of the atomic structure of matter. So fantastic did it strike them, that when a wandering philosopher called Democritus of Abdera said, in 420 B.C., that things were made up of an infinite number of invisible atoms separated by large spaces and in constant motion, educated men thought he was mad, and advised him to take treatment from a physician called Hippocrates. (1) Democritus, a legendary figure, adopted the atomic theory of his master Leucippus—the true creator of that theory, according to some—who established that the "essence" of the matter which forms water, or, in other words, the immutable particles which change only with reference to their spatial relationships, does not vary when the water changes to ice and then changes back to water. Democritus, one day at the beach, picked up in one hand some sand and in the other a little sea-water and explained to his disciples that matter, like sand, was formed of minute grains which he called "atoms" (that is, indivisibles), and that the structure of matter was not continuous as the water he had in his hand seemed to be. We are also indebted to Democritus for the idea that light emitted by the Milky Way proceeded from innumerable stars invisible to ordinary sight, a hypothesis which Galileo confirmed 2000 years later as he looked through his telescope at the stars in the skies of Venice.

A century later, Epicurus of Samos continued this theory, establishing the existence of atoms endowed with "internal liberty, or free will" which allowed them to break away from their directions, which, according to Democritus, were predetermined.

But eighteen hundred years had to go by before chemistry would become a scientific



discipline and atomism could be confirmed, thus establishing atomic structure as the only explanation of the laws governing chemical reaction. Dalton, in 1808, and Avogadro, in 1811-17, confirmed the molecular atomic structure of matter; Lavoisier in the eighteenth century discovered the law of the conservation of matter; and Mayer and Helmholtz discovered the law of conservation of energy. These contributions clinched the doctrine of atomism, full confirmation of which came in our time when it became possible to count atoms. In biology, atomic structure was also confirmed when it was established that the transformation of one type of molecule into another in the metabolic processes of organic matter, came about through the liberation or absorption of energy, as happens in physical reactions which take place in inanimate matter. With the advent of these doctrines, the world keeps on being a machine, but a machine made up of much tinier parts than before.

The seventeenth and eighteenth centuries are dominated by mechanistic thought, making of the inanimate world a self-perpetuating system in which all changes take place in accordance with natural laws. Copernican thought scientifically replaces the old ideas symbolized by Dante's concept that the earth is the center of the universe and is encircled by ten spheres.

Nevertheless, even in an age as scientifically important as the age of Newton, science attempts to prove that God is the creator of the law of gravity and other physical laws of the universe. The role of man in the universe is both elevated and lowered in this supreme attempt to conciliate science and faith. In that eternal conflict between tradition and observation, the history of human thought can be summarized.

For the physicists of the nineteenth century, the universe was built on the scaffolding of the Newtonian laws of motion. They took no account of the idea of force, merely of material changes. Matter was thought immutable. The most they accepted was the idea that combustion liberated energy, although they did not believe that matter was transformed into energy. The chemical elements were considered indestructible and it was not thought that one atom could be transformed into another, as in the romantic dreams of ancient alchemists. Only the impossibility of explaining phenomena like atomic stability, X-rays and radioactivity, indicated that classical, mechanical, and deterministic physics, was incapable of interpreting all the phenomenon of the universe. (2)

### *C. The quantum theory—milestone in atomic physics*

In 1900, Max Planck, in Berlin, was convinced that the spectrum of radiation of dark bodies could not be explained by the principles of classical mechanics. Instead, he thought that perhaps irradiated energy was not emitted continuously but rather in quanta or finite quantities, proportionate in each case to the frequency of the radiations, said frequency being expressed in a figure which would be later called Planck's constant. (3)

This theory was received with great skepticism; it seemed strange to abandon the wave theory and return to the old corpuscular concept of light; but Einstein proved this theory by applying it to the emission of electrons by metals and to the thermic properties of crystals.

The inspired intuition of Max Planck inclined him to the hypothesis that the emission of light by radiant bodies came about through tiny indivisible explosions, an idea which struck people as fantastic as saying that a bullet reached its mark by short leaps. (4) This hypothesis was expressed with the modesty characteristic of genius, and remained submerged at the bottom of the stormy ocean of speculative theories which raged at the beginning of the century. But it meant that atoms, too vast to be considered the cornerstones of the universe, were being replaced by something infinitely tinier: the *quanta* or leaps of energy.

The quantum was thus born: the smallest possible action at play in a physical phenomenon. It was a bold concept which later would grow gigantically and become a veritable quantic revolution, forcing the dethronement of the rigid laws of ancient physics by laws of probability. Planck had demonstrated, at first only to a select elite of physicists and mathematicians, and as the years rolled by to the whole world, that the philosophic concept of continuity in the universe was only statistically apparent. The classical theories were the confirmation of the imperfection of our senses which created the idea of continuity in a universe where everything was discontinuous and spasmodic.

Planck's theory represents the cornerstone of the entire atomic science of our century, and its formulation was perhaps the most crucial hour in the history of science. The layman is still not fully aware of its importance. The man responsible for it has not yet received his due. Laurels do not always crown the heads of true victors in the Marathons of science.

The quantum theory proved that not only was matter discontinuous, but that energy was too. (5) This theory contained the germ of the theory of relativity. The atomism of energy also implied the atomism of time, since the new vision of the universe could not be static, but dynamic. In a way, it was a pity that the quantum theory was formulated five years before Einstein published his theory of relativity, because if it had been the reverse, it would not have been difficult to conceive that if matter and energy were simply different facets of the same reality, and if matter was discontinuous, energy had to be too. The veil which hid this very elementary truth could not be lifted for research men because in 1900 relativity was unknown and the ideas of Planck were considered by many as simply the expression of an empirical thought. Planck had to wait more than a quarter of a century to see the blossoming of his conception, which would entirely transform the structure of the universe in the mind of the present-day scientist. (6)

The quantum theory reduced matter, up to then considered solid, to "waves of probability," an idea from which would be born, forty-five years later, the atom bomb. At first the public did not perceive the all-importance of the theory, perhaps because it is still so difficult for the popular mind to grasp anything expressed in terms of pure, higher mathematics without symbolic, graphic dramatization. But the scientific revolution was already on the march. Physics had been shaken to its very foundations.

#### D. *Philosophical meaning of Einstein's theory of relativity*

The next stage in the development of the new physics begins with the revelation of Einstein's theories which reduced to naught the old concepts of space and time. It was claimed that the conception of absolutely simultaneous events in different places has no physical meaning because the speed of the most rapid signals (light) is the same for all observers. (7)

Einstein's contribution to modern atomistic thought has been to revolutionize ideas about space and time, just as the quantum theory revolutionized ideas about matter and energy. The physics of the last century was materialistic and mechanistic. Today, matter is no longer considered solid, but rather a hollow in space and time, a tangle of electricity, a wave of probability undulating in a void.

Einstein has changed the twentieth century along with mathematics. Instead of level Euclidian space, he has created curved space, the curvature of which varies from one point to another, and the intensity of which at one point measures the intensity of the field of gravitation in the same point. But the fundamental philosophic significance of Einstein's ideas lies in the creation of a theory incorrectly called "of relativity," (since the relativity refers only to the values of reality—space, time, matter, energy—which were until then considered absolutes) in contrast with the absolute, which is human awareness of the aforesaid values minus the classical notion of the infinite. What this theory does is to make the universe in which we live a finite sphere, subject therefore to laws which can be investigated by man.

The fundamental metaphysical concepts of space and time, matter and motion, cause and effect, have therefore been replaced by new ideas and have suffered a holocaust as a result of the impact of the new science. (8)

#### E. *Philosophical topography of the new atomic science*

Recently, a voice (E. M. Forster) has been raised, making the "implacable offensive of science" responsible for the present chaos. But the civilization of the twentieth century, like a bicycle in motion, cannot stop short, because the only thing which supports it is its own motion directing it to new frontiers of energy. Just the same, the impact has been terrible. Scientific tradition, along with other traditions, has suffered a tremendous shock. Once again, science has collided with tradition—made up of the ideas of the past, according to Freud's concept of the super-ego—which plays a very important role in human life.

As a result of these portentous years, the complex structural edifice of classical science has crumbled. Modern science speaks a language totally different from that of former times. The practical difference between the Newtonian theory of gravity and Einstein's is probably small, but the theoretical difference is tremendous. When we speak, for example, of space-time instead of space and time as separate entities, we are simplifying scientific language, just as a physician by the name of Copernicus did in his own doctrine

many centuries ago. When we describe the universe as a four-dimensional sphere of finite diameter, we are simplifying the concept of this universe. When we refer to curved instead of straight lines in the theory of relativity, we are witnessing a semantic change along with a scientific one. Ideas have changed and with them, language.

If we go over this gigantic revolution in the spheres of physics and mathematics, we see that it has resulted in the disintegration of the old ideas which prevailed up to 1900 and conceived the universe as a solid and immutable stage on which our life was acted out.

This picture has been converted into one of a fluid world where there is nothing constant, fixed, or immutable, and in which waves of energy, laws of probability, discontinuity, change by leaps, relativity of space and the unity of space and time, have replaced the former rigid notions. (9)

To sum up, the characteristics of physical atomism which have left an indelible mark on the face of our times are the following: a) a new science has been established—atomic physics—idealistic in its conceptions and so hypothetical that one of its basic factors, the concept of the electron, is purely imaginative; b) as against observation and experimentation as bases of the biologist's work, and as against the physicist's measurements, the new mathematics accepts reason as superior to experiment for arriving at an integral comprehension of the universe; c) the discontinuity of matter is accepted; d) matter and energy have been proved identical; e) it has been established that space is finite; f) the relativity of time has been proved; g) the continuity of time and space has been demonstrated; h) it has been demonstrated that the universe is curved and four-dimensional; i) it has been demonstrated that matter moves by leaps of energy, and the latter has been accepted as the basis of modern physics; j) the substratum of mental life has been reduced to molecules and irreversible processes subject to physical determinism. (10), (11)

These principles summarize the new scientific philosophy elaborated from 1900 forward: the psychological impact of such philosophy on the mind of the artist has determined the features of modern art.

## II

### THE PSYCHODYNAMICS OF MODERN ART

#### *A. Interrelations of scientific and artistic thought*

One of the characteristics of modern psychology is the broadening of its field of action so that it can be applied practically to a better understanding of human experience and conduct. In the ninety some-odd years which have transpired since its birth as the step-daughter of philosophy and physiology, psychology has become wide enough to embrace problems as varied as the neurohumoral mechanism for transmission of the nervous impulse and the determining factors of man's desire to understand the universe. (12)

Like the new physics, modern psychology is a science of relationships. For that reason, we consider as worthy of study the interrelation between atomic science and modern art, both genuinely representative manifestations of the spirit of our age.

All through history scientific truth has influenced artistic thought, and vice-versa. The artist does not, of necessity, deliberately reflect scientific truth in his art, but if the climate of an age is saturated with new ideas, the artist—the most sensitive barometer there is—reflects those ideas in his work. Here we cannot help recalling the wise dictum of Zola: "*L'Art c'est la Nature vue par un tempérament.*" This temperature of the artist is subject to the influence of anything that happens on the horizon of his time. To evoke the scientific revolution of our century and its psychological impact on the artist is to point out facts which have passed unperceived and may shed new significance on ideological tendencies, thus influencing the course of the artist's future activity.

When we undertake to establish the impact of scientific atomism on modern art, we are attempting to anticipate to a certain extent the interpretations of the historians of the future, when the perspective of our time will be more serene.

Just as physics and mathematics in the seventeenth and eighteenth centuries helped to discover the circulation of the blood and respiratory physiochemistry, so scientific progress in the nineteenth century has had widespread cultural repercussions.

In 1865, Claude Bernard in his "*Introduction à l'étude de la Médecine Expérimentale*" formulated the principles of a new medical science, which was considered a positive science based on reason and the experimental method. His lectures and experiments at the Collège de France attracted physiologists, chemists like Berthelot, philosophers like Janet, historians like Renan. At the same time, the clinical lectures of Trousseau, and later those of Charcot at La Salpêtrière, were attracting numerous writers, philosophers, historians and artists.

The repercussions were disconcerting. Renan asserted that history was a science like chemistry; Taine affirmed that vice and virtue were chemical products like vitriol and sugar and, inspired by Claude Bernard, he formulated his deterministic theory of heredity and environment; Victor Hugo declared in 1859 that the mission of the poet and philosopher was to try to treat social problems as the naturalist treated zoological problems; Flaubert affirmed that the novel should be scientific. These influences gave rise to novels which were real clinical histories, like those of the Goncourt brothers and Emile Zola, just as later on Freud and psychoanalysis were responsible for the psychological novel, which is still the most widely-read literature of our day.

#### B. *The artist and his times*

For the artist, as for any other man, to live is to accomplish the bidimensional task of experiencing life from without and giving free play to his own spontaneity. The artist is above all a man subject to a double series of biological stimuli, proceeding both from his milieu and his own individuality.

Ortega y Gasset has spoken of man's double dimension: his historical dimension (his heredity) and his ambition for the future. History and destiny. Both factors are the determinants of the equation of life, the unfolding of which may be at times as clear-cut as the demonstration of a mathematical theorem.

The artist, who is first a man and next a professional, determines his organic adjustment through his sensory organs, and his being is made up of himself and his "circumstance," as Von Uexküll has shown.

The modern artist whose work has developed in the last half century has been subjected to the historical climate of our time, of which the most prominent influence has been the scientific revolution. In past ages the artist used to translate the ideas of the governing class, using as his raw material landscapes, figures and backgrounds of his time. In the atomic age, which started at the beginning of this century, the artist has been governed by the force of the new ideas which form the ideological organism of the new century.

More artisan than bohemian, the present day artist is both a businessman in his transactions and a scientist in his techniques. That is the principal difference between the artist of today who puts everything into the profound study of his theme and puts his technique to the service of an idea, and the classical artist of yesteryear for whom inspiration and improvisation were supremely important.

Let us not forget that every stroke of the brush has behind it a hand and an arm directed by a man whose brain has been continuously permeated by the ideas of the century in which he lives. It is important to him that he lives in a century shaken by political movements and colored by tremendous wars, a century also of gigantic scientific advances which are being applied to fabulous technological projects and apocalyptic orgies of destruction.

The brain of the artist, like a small cosmos, has been illuminated by the sun of new ideas, and his hand has been influenced by the new techniques of scientists, who move the hands of the artist in his studio just as surely as they guide the hands of the technician in his laboratory.

### C. *Psycho-historical profile of modern art*

In the first part of this paper we selected the date 1900, the year in which Planck formulated his quantum theory, as marking the beginning of the new atomic science. (13)

We can select the year 1907, when with his "*Les Femmes d'Alger*," Picasso gave to the world his cubist manifesto, as the year which saw the initiation of non-objective abstract art. The connection between this new art and atomic science forms the subject of the second part of this study.

Let us review briefly the historical development of modern art, its general characteristics, and the psychological impact of atomic science on the abstract art of our time.

Up to the eighteenth century, the artist depended almost exclusively on the patronage of the Church and the Royal Court. From the French Revolution on, it was the merchant who supported the artist, commissioning him to execute pictures on peaceful bourgeois themes. That forced the artist to choose subjects "that would be understood." Rebels like Courbet, Manet, Pissarro and Seurat, were isolated, and in their rebellion they were moved to use a semi-scientific objective method to register light, which consisted in employing pure colors



that would blend in the eye of the spectator and not on the palette of the painter, thus abstracting the form of things. Light, which so fascinated these impressionists, subconsciously undermined their interest in the form of things and in landscape as pictorial subjects.

As a reaction, and to restore the architectural structure of theme, Cézanne later used geometry, making of "the cylinder, the cone, and the sphere" the essence of all things; and Seurat employed vertical, diagonal, and horizontal lines as a means of achieving the denaturalization of persons and objects. In this way, both artists limited and denatured Nature, making of it a *continuum* of space-time, as the physicists and mathematicians would later do in the exact sciences.

Cézanne equalized the value of still-life and human form as themes. As the years went by, intellectual rebels projected into the twentieth century their unorthodox impulse to analyze in abstract art practical forms found in still-life, while those rebels opposed to the supremacy of reason would emphasize the dynamic space of landscape in their surrealist compositions. Such were the psychological determinants of the two great trends in modern art.

Cubist painting was born at the beginning of this century under the tutelage of Braque and Picasso, growing from the cult of the exotic, the ballet, the study of African masks, the interest in negro folklore and primitivism, from a desire for escape—because art is escape—and from the hunger for knowledge sharpened by the new science.

The objective of cubism was not to achieve visual pleasure but rather to make of art a scientific-philosophical instrument of investigation, to bring into relief new concepts of the reality of the visible world. This was a revolt, analogous to the scientific revolt, against classicism. Doubting the efficacy of the senses as vehicles of knowledge, cubism fell back on the logical and plastic mind, rejecting architectural and schematic concepts of classical order.

Cubist art is incoherent because it adopts musical liberties and utilizes new combinations of known forms; in doing so, it breaks objects up, putting them together again in a new structure. Its purpose is the organic development of non-symbolic pure forms in an imaginary bidimensional space; the idea is not to paint themes, but pictures.

The planes of cubism are those of synthetic vision which approaches the observer and does not withdraw in deceptive space, as happens in classical paintings. The frame of the picture is not a window looking out upon distance, but a limit of space. The picture is monochromatic and bidimensional, so that it may come closer to the spectator. This is a cloistered art of still-life, of static interrelations and immobility.

Cubism represents the final stage of the cycle initiated by the classical painting of the *Quattrocento* which was concerned with the bulk or empty spaces of things: the painter tried to represent things objectively. Much later came the *impressionists*, who no longer painted things, but sensations; it was subjective painting, not interested in what the artist saw but rather in the very act of seeing. Cubism comes as the last act; these painters are no longer interested in things or sensations, but in ideas. They gave up an objective art like the classical, or a subjective art like the impressionistic, and became projective.



Turning his back on the world, the painter refused to use his retina as a mirror to reflect around him; instead, he closed his eyes and projected his ideas.

This evolution in art runs parallel with the evolution of physics, which passed from investigating things by naturalistic observation to studying the perceptions of things, and ended up by analyzing their ideological scheme. This transition in both the scientific investigator and the artist from external reality to subjectivity and intra-subjectivity—that is, the displacement of the angle from which they viewed the universe—provides the vital interpretive clue to the evolution of scientific method and modern artistic technique.

*Futurism*, which was born in 1910, is interested in landscape just as cubism is interested in still-life. It is the art which glorifies the dynamism of the machine, and was born in the North of Italy, during those years when a gigantic explosion of industrial power had taken place there. The widespread use of machinery in industry, and incipient fascism, together with the worship of power, dynamism, speed, "the dangerous life," all incubated futurism. It was an art of movement and force, of persons and animals in motion, mad streets, whirring machines, factories and cities, which sucked the spectator up in their whirlpools. It was not a cloistered art like cubism; it sought its impetus in the public square and in dynamic interrelations.

After that came the advent of *surrealism* with Dali, Ernst, da Chirico, Klee and Tanguy. A fantastic art, it included works characterized by deliberate incongruity and inconstancy, having as its principal aim to shock the observer with the unexpected, violating all convention and custom, creating its own laws in a lawless world. The trick of this technique was to paint with great realism each fragment of the unreal taken from a universe of phantasmagoria and nightmare; but the care taken in the painting of the component parts of the dream caused the unreality to be accepted as possible. Their themes were extraordinary visions fabricated out of ordinary, familiar things, with double images, each one of which represented something completely different but connected by the non-logic of dreams. It was an art which exalted spatial, subconscious liberty; it was a visceral art, deep, cavernous, dissecting, interested in the human figure and in landscape. Remotely related to the expressionistic compulsion, it sought dynamic space and organic forms in landscape. (14)

#### D. *The psychodynamics of abstract art*

The next step was the birth of purely *abstract* art, which actually originated many centuries before our time, when the Flemish artists of the fifteenth and sixteenth centuries began to abstract, that is, to eliminate superfluous elements from their pictures, leaving only the basic factors.

In our time that tendency has developed to the maximum in abstract art, having four determining factors: (1) the progress of photographic art, which convinced the painter that the camera could in many cases get results objectively superior to those achieved by the paint brush; (2) the influence of music, which inspired the artist to create a universal art, an international language of emotion which would be free in space, as music was free in time, from the provincialism of local themes; (3) scientific discoveries, especially

the high-powered microscope and the long-range telescope which widened the visual horizon of man; and (4) the development of stroboscopic cameras which register all speeds.

All these factors, together with the perfecting of machinery and the introduction of cylindrical, conical and spherical forms, have been replacing forms found in nature, and have been influencing the artist slowly to abandon the universe which he has been looking at from age-old angles in favor of a universe which reveals itself in fragments and strips but which is daily growing. Not only has the traditional order of space, form and color undergone a revolution analogous to the scientific revolution, but the factors of time and motion have been added.

In its most intellectual and geometric as well as its most emotional and romantic forms, abstract art has followed various trends which can be summarized as follows: (1) Preference for themes based on mechanical or architectonic forms, still-life and inanimate objects, favoring the representation of the mechanical, the mineral, the telluric or lunar, and the machine-like. Rarely does the animal or human figure appear in abstract art, except in surrealistic art, which seems to have turned its back on the external, objective world. (2) The introduction of color as a dynamic element of form itself and the introduction of time and motion in an art which up to our century has been eminently static. Abstract art, like the new physics, enjoys animating the static or inanimate, as if it were attempting an atomistic unification of the living and the non-living. (3) The desire to attain an almost mystical unity.

In abstract art, as in the new physics, there is a contrast between the rigorous austerity of its scientifically objective methods, and the mysticism implied in its ultimate aim of understanding—and regulating—the universe. (15)

Abstract art may be classified according to whether its main objective is the representation of *abstract geometrical form*, *stylized geometrical representations*, *abstract organic forms*, or *stylized organic forms*.

In the first group we can include pictures without definite subject, representing only a geometric form pure and abstract, intersections of lines and right angles, series of geometric forms the asymmetry of which gives the spectator a pleasant, harmonious impression, like that he receives from certain fugues of Bach, the mathematician of music. It is an art which avoids the curve and takes pleasure in the line and right angles, uses great unadorned rectangles of uniform intensity without shading, separated and at the same time united by narrower bands. Pure art is abstract, ascetic, of immaculate whiteness and great mathematical precision. Its supreme exponent was the Dutch painter Mondrian, creator of an abstract space of primary colors and of a pure, almost musical rhythmic form, selecting those colors which corresponded optically to the spatial form desired. His principal apostles were Van Doesburg, Gabo, and Nicholson, their art being symbolic of our era of advanced engineering obsessed by mathematical order and the mechanization of the universe.

When to the aforementioned style is added the representation of an object, there is created an art of stylized geometric representation. Its objective is to represent objects

geometrically, stripping them of all superfluity and leaving them reduced to their schematic form, to their skeleton, to the pure symbol of the thing. Vertical and horizontal lines are used to represent objects which are sometimes solid and compact. Not only the inanimate but also the living can be represented geometrically in this group, provided it appears only in mechanical forms meant to accentuate the basic structure of a thing. A jar or a bottle is represented by Morandi as *the jar* or *the bottle*, symbolizing all the jars and bottles of the world. They are not things; they are the telegram of things, the geometrical shorthand of things. Instead of lines and straight planes, this art constructs volumes of three dimensions, especially cylinders, cones and spheres, which according to Cézanne were the basic elements of nature. Light is always theatrical in these pictures, and objects appear in dramatic isolation, or grouped in the form of a cluster of symbols. Fernand Léger was the shining star of this style, and Archipenko and Le Corbusier his satellites.

Sometimes abstract art may utilize forms which unmistakably represent or suggest life and living things. It is the art made famous by Calder, Noguchi, Joan Miro and Jean Arp.

The works of Jean Arp look as if a piece of sculpture representing a human torso had fallen on a beach and had been abandoned to the elements; beaten by the waves and whipped by the wind for years, its edges finally become smooth, its planes soft, its contours vague, its juttings and angles round. There would remain then, what we might call the spirit of primitive art; that which exists in a human torso underneath its angles and curves, its folds and its edges. Arp has shrunk the work of Nature and has proceeded by leaps, all of which coincides with the laws of Planck and the theories of Uexküll.

This art embraces figures which are painted or sculptured irregularly; figures of fluid contour which avoid the regular geometric curve as well as the straight line; curves are not traced by repeating a basic unity, but rather grow in accordance with the rhythm of changing development. The resulting form cannot be broken up into parts and must be considered as a unique whole. Each unit of these free forms should not be broken up into parts but apprehended as a whole, united in its parts by a surface or a tension of contour like that of the cells of living beings. Its unifying principle is internal, and each constituent form embodies the possibility of change without losing its identity.

Sometimes, organic form is applied to the image, not for the purpose of including objects in a measurable order and rhythm as geometric form would do, but to give to things the fluidity of form. Instead of skeletal structure, this type of *stylized organic form* prefers the bulbous and protuberant outlines of soft and stylized contours, indicating that the most complex forms of life that we know derive from simple cellular organisms and resemble each other. They are symbolic forms similar to the natural species from which they evolved, but with their own laws of development. They are, for example, parts of the human being, hands or feet, isolated and alive, tragic or humorous comments on the human being whom they still resemble. Miro, Henry Moore, Picasso and Paul Klee are the prophets of this style which sometimes is a wandering line, or figures seemingly created from

aimless lines, or even an abstract form of a wavering and cabalistic nature, the possibilities of which have been exploited by modern caricaturists.

*E. A commentary on the sense of form in modern art*

The revolutionary change which abstract art represents in comparison with classic art may perhaps be best appreciated in its concept of the human form, which deserves some special observations.

Artistic anatomy has successively reflected in its iconography the climate prevailing in each historical epoch, such as the medieval allegorical-religious vision, the architectonic style of the Renaissance, the mechanical movement of the baroque, or the evolutionism of the past century. (16)

In our times, the change in human morphology which is reflected in abstract art runs parallel with the change which took place in the conceptions of scientific anatomy. In the last twenty years, many voices have been raised proclaiming that morphology as a science was suffering from ankylosis and that one should revive the anatomy of the corpse, making of it a fertile synthesis instead of sterile analysis. Anatomy should be closer to physiology, biologists and anatomists have repeated insistently; it should give up the study of particularities, and be dynamic instead of static. This desire for dynamism in the study of form has manifested itself in dissection halls as well as in artists' studios.

Old anatomists studied the human body from the standpoint of its projection in space, leaving to physiology the study of its projection in time. (17)

The anatomist of the last century, just like the artist, studied the human being as a self-enclosed whole. The focus was therefore on causality, on studying the living being as a geometric figure, as something already given, in the platonic sense. It was a mechanistic static conception which, translated into artistic terms, meant the purely aesthetic realization of a stylistic idea. Human beings were thought of in terms of platonic ontology, matter being modelled after the eternal archetype of ideas.

The new anatomy thinks of the human being as pure process, and it is interested as much in his origin as in his future development and the meaning of his biological changes. It is an arithmetical, finalistic view which places focus on the living being as a physiological process; it is a teleological notion in the Aristotelian tradition, considering every being to be made up of matter which is a potential, and form which is the act or entelechy. This conception has been translated into art through the study of human form subject to a biological conformity to plan and with a dynamic tendency to some end. As against the classical notion of form as an idea, modern art posits form as a function or as an end in itself.

Abstract art, like modern anatomy, accepts the fact that form can be an end, a basis of function, or function itself, preceding structure. Form is not conceived as a simple manifestation of the living being in space, but rather as function projected into time. The new artistic morphology is above all physiology. The modern artist can no longer think of pure spatial geometry separated from time, any more than he can conceive of

pure temporal physiology liberated from space; for that reason, he has incorporated form and function into his art as supreme manifestations of the living being, just as matter and energy are the manifestations of the inanimate.

Practically speaking, this has meant a revolution in the art of looking at living beings. Bones, muscles, and other anatomic structures are still in the positions they always were, but the point of view from which we regard them is no longer what it was. The object observed has not changed; what has changed is our own vision. Human form is no longer for the abstract artist a mere expression of the living being, or the result of a spatial scheme, but pure dynamic process, motion in time. That is why the abstract artist has given up the staticism of classical art which prevented him from seizing the functional realities of form, and has become eminently dynamic, constantly striving after form as function in time and space.

### III

#### THE PSYCHOLOGICAL IMPACT OF ATOMIC SCIENCE UPON MODERN ART

##### *A. The psycho-biological process of the formation of the "spatial scheme" of the milieu*

What have been the consequences of the psychological impact on modern man of this atomistic *nuova scienza*? We can summarize them in a single statement: that the result of the conceptions of modern physics discussed previously has been to destroy completely what we may call the mental spatial scheme man had of the universe.

The human being lives in surroundings which convey to him, through the windows of the senses, impressions that engrave on his nervous system certain structures called engrams and which finally become part of his organism. The totality of these impressions made by various engraphic stimuli forms what can be called the *internal correlative of the outside world*, and creates in the human mind the spatial scheme of the milieu.

Since the form of the engrams varies in accordance with the internal nervous structure of each organism, we have to accept with Uexküll that each animal has its special inner world in which a specific graphic architecture exists and supports his image of the external world. This means that the outside world of the jellyfish differs from that of man, and the outside world of man differs from that of the badger or the butterfly, because each species receives different stimuli — graphic, visual, olfactory, tactile, auditory, thermic or pressor — which engrave a different internal image and spatial scheme of the world in each species. And so the expression "outer world" is a variable one and depends on the point of view of the species under consideration.

The aforementioned engrams and the external stimuli which cause them are constantly conditioning the activity of the living being, including his aesthetic conduct. The human being therefore forms his universe in the image and likeness of the engrams that he possesses. Man's idea of the universe varies with the sensory and mental images which man forms of the universe, thanks to his reading and thinking. Although external stimuli may be exactly the same, the organism reacts to them differently at every turn. His

reaction is therefore conditioned—in the Pavlovian sense—by external or sensory and internal or biopsychic stimuli.

For thousands of years, the human being has lived with a spatial scheme in his mind from which came his image of a geometrically perfect universe, situated in infinite space, in which matter was all, matter being immutable and obeying laws which were even more immutable. When atomic physics broke up the universe into atoms, it altered its perfect geometry, turning it into a chaos of probabilities; it replaced its perfect continuity with physical discontinuity; it established change by leaps in place of continuous evolution; and it completely undid the spatial scheme of man on which was based his image of the universe. Instead of his former spatial image, which was firm, certain, definite, solid, and continuous, man found himself with the image of a finite sphere in which everything was change, improbability, disorder, discontinuity and spasm.

#### B. Destruction of the bodily image of man

The consequences of the new biology and psychology were equally cataclysmic for the spatial and bodily schemes of the human being. The new biology, with Von Uexküll, showed that it was necessary to discard Darwinism and in its place establish that the process of life was that of beings whose structure was based on a conformity to plan, and that they progressed by biological leaps—not very different, in our opinion, from the physical leaps of Planck. Thus, the leap totally replaced uninterrupted evolution in the interpretation of the biological process.

The new histology, backed by the high-power microscope and finally by the electronic microscope, also revolutionized the concept of the *bodily image*, that is, the morphological scheme which each human being has of himself and of his fellow-man. (18)

Up to the beginning of our century, anatomy was static, solidified, fixed, rigid, and the human being was conceived of as a small microcosm of solid parts and subject to laws, weights and measures, just as the macrocosm around him was subject to the laws of physics. The new ultramicroscopic histology, breaking the human being up into elements so far invisible, plus the new physiological and dynamic conceptions of what previously was static human anatomy, destroyed the bodily image of the human being too, and transformed the former orderly conception of the human organism into a confused image of molecular elements in constant change and restlessness.

(In the joyous days of pagan art, the skeleton was invisible in painting. In the Middle Ages, gentlemen, ladies, bishops and pages show their flesh but neither skulls nor bones appear on paintings. Aldous Huxley once asked why—and found no answer—the skeleton appeared so late in art. In my opinion, the explanation is that in 1543 there appeared the first work representing a spatial scheme of anatomy and the beginning of modern science; this is the *Fabrica* of Vesalius in which the magic of Calcar's illustrations under the supervision of the brilliant Belgian, introduces into art the skeleton as the supreme expression of the human form. In the wake of this work, artists start sculpturing anatomical structures on tombs. In the seventeenth century these statues stand up and open their



eyes. At the feet of the figures skulls are sketched, perhaps in memory of the syphilis pandemics which destroyed the noses of the infected and reminded them of the existence of the skeleton. As time passed the skeleton grows and sprouts wings on figures decorating mausoleums.)

The psychoanalytical psychology of Freud contributed to this revolution by establishing the supremacy of non-rational life over rational life, and by creating an abyssal psychology which gave greater importance to the deep, instinctive, non-rational aspects of the mind than to conscious life. A world of darkness, sex, violence, and aggression, took the place of an orderly, moral world created laboriously as psychic superstructures for culture and religion. Thus, the third basic image or scheme of the human being, that of order, fixedness and law in his mental life, was also replaced by the new Freudian scheme in which the instinctive zone of the mind was the decisive factor.

*C. The psychological impact of atomic science on modern art*

The man of our century reacted to this cataclysmic destruction of the basic values of his life, of the spatial scheme of the universe, of his bodily image, and of his psychological self-image, with a vague, but often violent restlessness. But the artist, who is always the finest spiritual barometer of an age, reacted even more radically, reflecting in his techniques the disquiet he felt at this break-up of vital schemes, and by trying to rebel, or to resolve in his own way the cataclysm which threatened those values hitherto considered immanent in the human being.

The object of the artist is to reproduce the beauty of the external world. But beauty is not, as Kant demonstrated, a predicate of things endowed with objective reality, since the aesthetic canon varies from one country to another and from one age to another. A Zulu's conception of beauty is far different from an Eskimo's; El Greco's standards of beauty differ appreciably from those of a contemporary surrealist. Therefore, as the scientific attitude towards external objects—that is, the universe—was altered, and spatial and bodily schemes of the subject changed, a tremendous change was brought about in the aesthetic canon of our century. (19)

The painter, whom we have adopted as the most patent example of our thesis, uses today, as he did two thousand years ago, one of the two great aesthetic senses: sight, which perceives external plastic stimuli of a static type, and upon which are based the spatial or visual arts (painting and sculpture), just as the temporal or auditory arts are based upon the use of hearing, which captures rhythmic and melodic stimuli.

The eye gives a simultaneous impression of external things, just as the ear gives the succession of time or rhythm. (22) That is why there is an overlapping of the spatial-simultaneous stimuli on the one hand, and the temporal-successive on the other. Visual art requires, under any circumstances, a spatial-temporal correspondence, which already existed for the artist long before Einstein discovered it in his theories of relativity.

The modern painter found that he was subject to influences which had impregnated our times like a bolt of electricity. When the notion of a stable universe was proved a fallacy,



and the image of his own body was altered, the artist's spatial scheme of the world was destroyed.

The key to the meaning of modern art, the art which sometimes strikes us as incoherent and deformed, lies in the fact that the abstract painters, who feel that their spatial scheme of the world is broken, reflect this mental commotion in their pictures, and paint a dislocated universe, with fractured planes, without continuity or solidity, in which space and time blend in plastic relativity. This is a world in which the artist's brush seems to be moved by the same Planckian shock that is disturbing the universe of atomic physics.

*Abstract art is, then, the diagrammatic representation of the break-up, wrought by atomic physics and modern science, of the spatial scheme in the mind of modern man, especially the artist.*

Furthermore, the strange view which surrealist artists have of modern man (combining the human being with inanimate objects, as Max Ernst does, or doing this with a vague, gelatinous and transparent consistency as in Dali's case, or presenting him from within, like Henry Moore) is a representation of the breakup of the bodily scheme (21), to which the artist has been drawn by the conceptions of modern physiology and biology. (22).

#### *D. The artist rebellion against the influence of the new physical science*

The modern artist has reflected in the technique of his work the psychological impact of atomic physics, but, on the other hand, he has fought against that influence in each facet of his art. In order to fight against the break-up of his spatial scheme wrought by the new conception of the universe, the abstract artist has enclosed this universe within the frame of his picture, and especially within the finite, Einsteinian space of the bidimensional universe created by cubism. In this way, he has tried to limit the infinite just as physics has done, and is attempting to impose order upon his cosmos through artistic limitation.

Secondly, he is doing everything he can in the cause of order, harmony, and clarity, when he frees himself from superfluous forms, colors, and rhythms, and seeks, like Mondrian, the supreme perfection of order, clarity and calm in his white, fixed universe of straight lines and harmonious angles. That universe which was converted into a chaos in the artist's mind by the break-up of the spatial schemes of the world about him, he now tries to reconvert into a cosmos of harmony and clarity.

In the third place, with the break-up of spatial schemes in his mind, the modern artist has ceased regarding the object like Velasquez did; he even ceases to look at light like the impressionists did; he must withdraw more and more, he must shut himself up within himself, in a voluntary process of progressive psychic blindness. This protest is comparable to the hysterical blindness in which form is first lost, then light and color. Scorning the unstable outer world of disintegrated structures and uncertain laws, the abstract artist has created his own world of ideas as in the case of the cubist painters, or has tended to restore a bio-psychological order of his own as in surrealist painting.

The solitary spectral figures of da Chirico shivering under the silvery moon shining on

Venetian piazzas, or Dali's figures alone in deserted lunar places, impress us as beings submerged in cosmic loneliness which the artist himself feels because atomic science has torn his universe away from him, leaving him to the solitude of his ideas.

The artist's canvases dramatize his double conflict: his anguish over a universe which has fallen apart, and his profound desire for order, reconstruction and harmony. This conflict has exploded like a geyser into an art which is incomprehensible till we correlate it with the conceptions of modern physics.

In a hundred years science has proceeded from the study of things to the study of sensations and ideas. At present, physics is attempting, from its fixed world of ideas, to dominate the changing world of things and sensations. Art, working in analogous channels, is trying, from the watchtower of ideas, to create ideological painting. Modern painting is trying to present the chaos which exists in the physical world of today as it appears to men who do not understand its scientific structure; at the same time, it is attempting to convert this universe into a pure and harmonious cosmos through the magic of art.

*E. A glance towards the future of art*

One can foresee what the future holds for modern art, in the same way one can mentally reconstruct the whole length of a half-destroyed bridge by looking at the arch of broken stones which still curves halfway over a river and imagining what the other half of the curve would be like. By means of such psychological extension, it is possible to foresee the trends of art in the future.

Today's artist has reflected in his work the psychological impact of atomic science, which has destroyed the basic schemes of his existence as man and artist: his spatial scheme of the universe and his bodily and psychic image of himself.

But a further reaction is already apparent in the art of painters like Dali, one of the most fanatical of surrealists, who in his most recent period is turning his back on surrealist art and is painting "atomic Madonnas" and a mystical universe where everything floats in phantasmagoric levitation.

The modern artist, in reaction against the disintegration of the universe brought about by the physicists, is reconstructing this universe in his work. If we listen carefully to the voices of abstract artists we can detect in all of them the same note of mysticism, the same transcendental desire for unity and for ineffable communion with eternal, stable, and absolute forces. *Abstract art masters all techniques, but at bottom there palpates as a unifying element and common denominator the desire for integration, for unity, for solidity, for continuity: the desire to find again the lost unity of the cosmos, of man with himself, and of man with cosmos.*

As his only means of restoring the broken unity of matter and spirit, the artist has chosen the path of integration, oneness and simplification. *Abstract art is simplification; it is stripping the universe of color and form to create it anew, the point of departure*

being the naked, cold, pure idea. Quasi-religious mystical integration of a new universe will be the aim of the new art.

On the basis of that same objective of unity and integration which pulsates in the new atomic science as the philosophical key to its structure, we can anticipate that modern art will tend, in the next half century, towards a new lay mysticism based on the principles of the new physical science and intended to restore the lost unity of the spatial scheme of the universe and man's bodily image. We can indeed foresee it as a tremendous endeavor towards the artistic integration of man and his cosmos.

#### SUMMARY

The year 1900 marks the beginning of a crisis in the conception of the universe. The new atomic science, Einsteinian physics, the quantum theory of Planck, the new astronomy, and modern mathematics, as well as ultramicroscopic biology, have revolutionized the concepts of classical physics. The new picture of the universe; the acceptance of finite space, the identity of matter and energy; and the idea of the relativity of time and its continuity in space, have caused a crisis in man's concept of the world around him and of himself.

The work of the artist has reflected this crisis, for there is a historical interrelation between scientific thought and artistic sensibility. Since 1907 the new forms of modern art — surrealism, cubism, and abstract art — have shown the psychological impact of atomic science, which destroyed the spatial scheme and bodily image of man. The spatial scheme in the human mind is born as a result of the engrams engraved on the nervous system by sensory stimuli and by mental images evoked by meditation; in that spatial scheme lies the key to the concept man has of his milieu. The bodily image in the human mind comes from cenesthetic intraperceptions and the reaction of man's psyche to external sensory stimuli.

Atomic physics and ultramicroscopic biology have destroyed man's spatial and bodily schemes. The modern artist has reacted by representing diagrammatically in his abstract art a dislocated universe. This universe is as disintegrated and discontinuous as that of atomic science. Space and time are fused, matter has been converted into energy in a limited and finite universe — the Einsteinian universe — and mutations are made in leaps of the quanta type. The human figure disappears from the cubist universe to reappear in surrealism, which portrays the disruption of man's bodily image and of his psyche. The technique and the subject of the modern artist have reflected this disintegration of his spatial and bodily schemes. At the same time, the artist has rebelled against such disruption of his world and mind, and has reacted with a strong desire for unity, integration, harmony, and order.

We may anticipate that art in the next half century will concentrate on simplification, integration, and quasi-religious endeavour to order, because the artist longs to restore the lost unity between the body and psyche of man, and to reinstate man to his rightful position in the cosmos.

#### RESUMEN

El año de 1900 marca el comienzo de una crisis en la concepción del universo. La nueva ciencia atómica, la física Einsteniana, la teoría del quantum de Planck, así como la

biología ultramicroscópica, han revolucionado los conceptos de la física clásica. La aceptación del espacio finito, la identificación de la materia y la energía, y la idea de la relatividad del tiempo y su continuidad en el espacio, han causado una crisis en el concepto del hombre acerca del mundo que lo rodea y de sí mismo.

El trabajo del artista ha reflejado esta crisis puesto que existe una interrelación histórica entre el pensamiento científico y la sensibilidad artística. Desde 1907 las formas principales del arte moderno — surrealista, cubista y abstracto — han mostrado el impacto psicológico de la ciencia atómica, el que ha destruido el esquema espacial y la imagen corporal del hombre. El esquema espacial en la mente humana es el resultado de los engramas grabados por el estímulo sensorial y por las imágenes mentales evocadas por la meditación; en ese esquema espacial se apoya el concepto que el hombre tiene de su medio ambiente. La imagen corporal en la mente humana viene de intrapercepciones cenestésicas y de la reacción psíquica del hombre al estímulo sensorial externo.

La física atómica y la biología ultramicroscópica han destruido los esquemas espacial y corporal del hombre. El artista moderno ha reaccionado representando diagramáticamente en su arte abstracto un universo dislocado. Este universo es tan desintegrado y discontinuo como el de la ciencia atómica. El espacio y el tiempo se fundieron, la materia ha sido convertida en energía en un universo limitado y finito — el universo Einsteniano —, y las mutaciones se han hecho en saltos del tipo quanta. La figura humana desapareció del universo cubista para reaparecer en el surrealista, el cual retrata la separación de la imagen corporal del hombre y su psique. La técnica y el objeto del artista moderno han reflejado esta desintegración de sus esquemas espacial y corporal. Al mismo tiempo, el artista se ha rebelado contra tal destrucción de su mundo y mente, reaccionando con un fuerte deseo de unidad, integración, armonía y orden.

Podemos anticipar que el arte en el próximo medio siglo se concentrará en simplificación, integración y esfuerzo cuasi-religioso, porque el artista anhela restaurar la unidad perdida entre el cuerpo y psique del hombre, restableciéndolo a su legítima posición en el cosmos.

#### RESUME

L'année 1900 a marqué de début d'une crise de la conception de l'univers. La nouvelle science atomique, la théorie de physique d'Einstein, la théorie des quanta de Planck, la nouvelle astronomie, et les mathématiques modernes, ainsi que la biologie ultra-microscopique, ont complètement bouleversé les théories classiques de la physique. La nouvelle conception de l'univers, la théorie maintenant admise du fini dans l'espace, l'identité de la matière et de l'énergie, et l'idée de la relativité du temps et de sa continuité dans l'espace, ont provoqué une crise dans la conception admise par l'homme du monde qui l'entoure et de lui-même.

Cette crise a profondément influencé l'artiste dans ses travaux, car il existe une corrélation historique entre la pensée scientifique et la sensibilité artistique. Depuis 1907 les formes principales de l'art moderne—surréalisme, cubisme, et art abstrait—ont reflété les répercussions psychologiques de la science atomique, laquelle a détruit l'ordre spatial et

l'image corporelle de l'homme. L'ordre spatial est né dans l'esprit humain par suite des engrammes imprimés sur le système nerveux par des stimuli sensoriels et par des images mentales évoquées par la méditation; c'est dans cet ordre spatial qu'il faut voir la clé de la conception que l'homme s'est faite de son milieu. L'image corporelle dans l'esprit humain est due à des intraperceptions cénesthésiques et à la réaction du centre psychique de l'homme à l'égard des stimuli sensoriels extérieurs.

La physique atomique et la biologie ultra-microscopique ont détruit les ordres spatial et corporel confus cédilla par l'homme. L'artiste moderne a réagi en représentant schématiquement dans son art abstrait un univers disloqué. Cet univers est aussi désagréé et discontinu que celui de la science atomique. L'espace et le temps ont fusionné; la matière a été transformée en énergie dans un univers limité et fini—l'univers d'Einstein—et les mutations ont lieu par sauts du type des quanta. La silhouette humaine disparaît de l'univers du cubiste pour réapparaître en surréalisme, ce qui reflète la dislocation de l'image corporelle de l'homme et de son centre psychique. La technique et le sujet de l'artiste moderne ont exprimé cette désaggrégation de ses ordres spatial et corporel. En même temps, l'artiste s'est rebellé contre cette dislocation de son monde et de son esprit, et a réagi par un désir très marqué visant à l'unité, à l'intégration, à l'harmonie et à l'ordre.

On peut s'attendre à ce que l'art, dans le demi-siècle prochain, se concentrera sur la simplification, l'intégration, et un effort quasi-religieux vers l'ordre, car l'artiste souhaite ardemment le rétablissement de l'unité perdue entre le corps et l'esprit de l'homme, et la réintégration de l'homme dans sa position légitime dans l'univers.

### NOTES

(1) His doctrine was revived with Heisenberg's atom, just as Democritus' more deterministic notion of the atom was reborn with Rutherford and Bohr. Around his idea of the atom, Democritus created a Cosmology based on atomism, and was opposed by Plato and Horace. Lucretius (75 B.C.) and Aristotle, contributed to the development of atomic theories; as a matter of fact, Aristotle laid the bases of scientific physics.

(2) In 1900 when Newton's theory of space and time was still accepted, "ether, absolutely at rest" was conceived as a substantial vehicle bearing waves of light through interstellar space. In that year, physical research still supported the idea of continuous matter; it was interested in the behavior of gross matter and paid no attention to its atomic structure. Technological advances were formidable in the fields of thermodynamics, hydrodynamics, electricity, aerodynamics, acoustics and ultrasonic waves. The most notable difference between the physics of 1900 and 1950 is the complete victory of contemporary atomists who have revived the old speculations of the medieval alchemists.

In 1900 the history of the atom began; its milestones have been the discovery of the electron (1894) by J. J. Thomson, the discovery of X-rays (1895) by W. K. Roentgen, of radioactivity (1896) by Henri Becquerel, of radioactive elements—radium and thorium—by Pierre and Marie Curie (1898), and the identification of atomic nuclei and alpha and beta rays from 1902 on, by the brilliant research of Rutherford and his school.

Today we know that the atom is made up of nucleons—protons of positive electric charge—of neutrons without electric charge, and electrons of negative charge, 1,800 times lighter than the nucleons. The nucleus of the atom is only one millionth of a millimeter in diameter, and is surrounded by moving electrons like the planets around the sun, in orbits with diameters that are 10,000 times larger than those of the nucleus.

(3) As he developed his equations, Max Planck observed that they could describe the emissions of radiant energy through leaps—which he called *quanta*—which varied with the frequency of light. His equation, now famous in the history of Science, was that “a *quantum* of energy equals ‘h’ times the frequency of the light.” The ‘h’ was the so-called constant of Planck.

(4) To the theory of the discontinuity of energy, Planck added the idea that just as atoms differ, depending upon the type of matter from which they come, some being heavier than others, energy atoms are also different one from the other, depending upon their source. The magnitude or quantum of the energy of radiation was directly in proportion to the frequency of the radiation. Planck’s constant was then not a granule of energy, but a *quantum* of kinetic momentum.

(5) The quantum theory cleared up the puzzle of atomic stability, and allowed for interpretation of the periodic systems of elements, but both the undulatory and the corpuscular theories of light kept on being popular. Planck’s formula was as follows.  $E = h\nu$  (the quantum of energy equals Planck’s constant of time-energy); Broglie verified the fact that waves behave as particles and vice versa. The unity of both aspects of matter and light was formulated mathematically by Heisenberg, Born, Jordan, Schroedinger.

(6) In 1913, Niels Bohr successfully applied the quantum theory to the phenomena of the atom, describing it as a sun in miniature surrounded by electronic planets which leap like waves from one to another orbit emitting (or absorbing) quanta of light without obeying regular laws.

(7) The most important Einsteinian law is the one which establishes the equivalence between mass and energy:  $E = mc^2$ ; c representing the speed of light.

Later, in 1908, Minkowski established the mathematical theory that space and time fused in a four-dimensional extension in which each point represents an “event” and in which the generalization of regular Euclidian geometry is maintained.

In 1915 Einstein extended the theory of relativity to the accelerated systems, obtaining a theory about fields of gravitation which embraced the Newtonian theory as its first approximation. His principal contribution was the prediction and verification, during the total eclipse of 1918, that the light which came through to us from the stars detoured when it passed near the sun. Astronomers developed the idea of the expansion of the universe, taking as their basis the discovery that distant nebulae or galaxies drew away from our planet at speeds proportionate to their distances. Later (1927), mathematicians developed a modification of the Einsteinian equation, which described a closed, expansional universe of curved spaces.

(8) Albert Einstein has said (in his article “*Physics, Philosophy and Scientific Progress*” [J. Internat. Coll. Surgeons 14:755-58, Dec. 1950]): “As a matter of fact, one easily recognizes certain principal features to which science has firmly adhered ever since those times:

First, thinking alone can never lead to any knowledge of external objects. Sense perception is the beginning of all research, and the truth of theoretical thought is arrived at exclusively by its relation to the sum total of those experiences.

Second, all elementary concepts are reducible to space-time concepts. Only such concepts occur in the “laws of nature”; in this sense all scientific thought is “geometric.” A law of nature is expected to hold true without exceptions; it is given up as soon as one is convinced that one of its conclusions is incompatible with a single fact which has been proved by experimental investigation.

Third, the spatio-temporal laws are *complete*. This means that there is not a single law of nature which, in principle, could not be reduced to a law within the domain of space-time concepts. This principle implies, for instance, the conviction that psychic entities and relations can be reduced in the last analysis to processes of a physical and chemical nature within the nervous system. According to this principle there are no nonphysical elements in the causal system of the processes of nature: in this sense, there is no room for “free will” within the framework of scientific thought, nor for an escape into what has been called “vitalism.”

Just one more remark in this connection. Even though modern quantum theory contains a weak-



ening of the concept of causality, it does not open a back-door to the advocates of free will, as is already evident from the following consideration: the processes determining the organic phenomena are irreversible in the sense of thermodynamics and of such a kind as to eliminate the statistical element ascribed to molecular processes."

(9) Astronomy of the last half-century has made strides like the analysis of stellar movements, the confirmation of the theory of relativity, the concept of spiral galaxies, the construction of gigantic telescopes, radioastronomy, the birth of modern trigonometric parallaxes, the exploration of stellar structures and of interstellar dust and gases, advances in photocellular astronomy. Immediate objects of study, according to Harlow Shapley, are cosmic physics, stellar spectroscopy, the study of the structure of the Milky Way, drawing of maps of remote galaxies, determination of the origin of the planetary system, and the study, through radio microwaves, of the meteors and cosmic rays.

(10) Atomistic physics is the physics of the moment, and tends to treat everything in a fragmentary, atomistic way. According to this theory the electron passes from one to another orbit through a series of very strange leaps because the electron does not pass from one orbit to another through intermediary space, but disappears from one place to appear in another. The electron *does not move* by leaps, but rather *exists* in leaps, evaporates in one place and appears in another, without having transferred to that other place. Therefore, the electron is the series of separate aspects it would present in continuous movement if such a thing existed. As the universe is matter and matter is composed of electrons, it has been suggested that the universe moves by leaps between which it disappears. Perhaps a similar theory might be applied to the human psyche.

(11) We admit today that living beings are made up of biogenetic elements of low atomic weight, situated at the start of the periodic scale, and they all have—all except zinc, arsenic, and iodine—atomic weights less than that of iron (56). At the other end of the periodic scale, we find the elements of greatest atomic weight, among which we have—beginning with lead (207), radon (222), radium (226), actinium (227) and uranium (238)—elements which, along with their isotopes, are all radioactive, that is, easily disintegrable atoms the fission of which takes place with liberation of energy.

The most unstable atoms are found at both ends of the periodic scale; silver is the only element of perfect stability and is near the middle point of the scale (108). The other elements are metastable in either direction, and liberate energy through the conversion of their atoms either when their nuclear components are added together in the lighter elements or when the nucleus of the heaviest disintegrates.

The biogenetic elements have, on the other hand, a greater nuclear stability. Seaborg compiled in 1944 a list of isotopes known at the time, of which 45 were radioactive. Tracing the frequency of radioactivity in the isotopes and in normal atoms, in successive groups within the periodic series, and considering the proportion of radioactive bodies in each group, we see that the curve superimposes itself on the curve of stability of the atomic nucleus. Gamow said in 1946: "the best opportunity of producing atomic transformations and liberating their hidden energy lies in both extremes of the periodic system: the heavy isotope of hydrogen deuterium or the light isotope of uranium (U235), both very rare elements on the planet."

(12) The changes in physics have led to similar changes in biology and psychology. Medicine today is more interested in intraorganic chemico-energetic changes than in cruder neurological alterations. The unity of matter and energy is not only accepted for the universe but also for the human body.

Comparison was made by Langdon-Brown between energy originally developed in the zygote, which provides the impetus that carries the organism like a bullet in its passage through life, to an explosion of atomic energy. At the moment of birth, there only remains 2% of the initial impetus which decreases constantly because it is subject to thermodynamic laws although the functioning of life maintains that evaporating energy at a useful level.

The organic and nervous tissues, like the molecular aggregates which they are, withstand the



changes of the individual molecules of their surroundings, but are subject to the statistical laws of physics.

Modern physics accepts the human body as a continuum of matter and energy, that like electrons charged with energy, only varies continually by leaps, according to the quantum theory, and moves, according to Schrodinger, in a continuum of space-time of four dimensions. Each organic system has a quantity of energy the level of which changes by that mysterious event which is called a quantum leap. Each molecule of said system is made up of atoms and has a certain stability and its configuration does not vary until it receives from without the necessary energy for said leap. Said difference of level determines quantitatively the degree of stability of a molecule.

These conditions exist in the human being from before birth. Modern physics considers the possibility that a gene or fiber of chromosome may be an aperiodic solid. This conception of a well-ordered association of atoms with sufficient resistance to preserve its order permanently, and to make isomeric adjustments, may perhaps explain the mystery of how the diminutive particle of the nucleus of the fertilized egg contains, as if written in a tiny code, the entire future development of the organism.

After birth, life continues as an incessant biochemical change, although it maintains its unity, integration and internal organization against attacks from without.

It is interesting to note that fundamental differences between living and non-living organisms have been abolished. Small viruses are considered by chemists as molecules and by biologists as cells, to which the quantum theory may also be applied.

(13) Human life, it has been said, has developed through the seizure of "levels of energy." Up to 5000 B.C. man limited himself to assimilating this solar energy through edible animals and plants, resulting in a very rudimentary culture. About 7000 years ago the agricultural man appeared, cultivating his fields with edible plants and thus absorbing more energy, a method which in 1000 years created vast civilizations. This stage lasted 6000 years. In 1700, in western Europe, "fossil fuel"—that is, coal, oil, and gas—was being used.

A new culture came to be when the first atomic bomb was exploded in Alamo Gordo, New Mexico, July 16, 1945, six years after Otto Hahn and Strassmann discovered the fission of the heavy nucleus of uranium. This scientific event, which had immediate practical applications in the manufacture of radioactive tracers, the treatment of cancer, the prolongation of life, and conversion of hydrogen into helium, will make possible the seizure of even more energy.

(14) The strange game of hide-and-seek present in so many surrealist paintings, for example, in Dalí and Tchelichev, like images of beings infinitely multiplied, is an allegorical representation of the psychological self-image broken also by the psychoanalytical impact. It is the mind looking for itself.

(15) They are sketches which contain implicit movement and are surrounded by an indeterminate space. They have been used on posters, advertisements, furniture, architecture and ceramics. Because they seem cut from a large drawing their free organic existence is striking. It is a style used in modern canvas hammocks and chairs, and in show-windows with tremendous success.

(16) According to Lain Entralgo, it is significant that anatomic nomenclature begins in history as numerical and expressing magnitude (*duodenum* = twelve fingers), and in the Renaissance changed to symbols of arrangement and relation (*deltoid* = delta).

(17) An analogous division might be applied historically, as the study of the human being in his spatial projection has been the subject of geography, just as the human being in his dynamic projection has been the subject of history.

(18) When this image disappears or is deformed by neurologic lesions, it can be freed from its bodily frame and converted into a hallucination, which has given rise in literature to the legend

of the human "double" the sight of which means death, and which is only the perception, without object, of our own bodily image.

(19) Of vital importance in the discussion of the impact of atomism on modern art is the fact that psychological perception is interpreted today as possibly being determined by physical factors. Perception does not receive the movement of matter but the effect of the impact of such movement upon our organism.

We construct the world on the basis of messages through the sensorial organs to the brain. The mind weaves an impression using the stimulus which reaches the brain through the sensorial nerves and which lacks color, temperature, sound and texture, qualities given to it by the brain.

Mental processes are the result of cerebral processes which, in turn, depend upon stimuli from the body or the milieu. What the mind contains is determined by the milieu, and vice versa. Organism and milieu are one whole. Our perceptions seize the configuration of situations. The qualities of the objects are those of the entire situation. Physicists and physiologists accept that cerebral stimuli are of atomic nature, but the brain receives separate impressions, and the mind does not end but rather begins with the global picture of everything.

(20) Formerly, artists commissioned by great lords and wealthy men to paint their portraits used to record very often the chronic illnesses of their models creating a splendid iconography of great medico-historical value. What the brush of the classical artists reproduced was simply the charming pirouette of the human body in a bronze by Donatello, the explosive anatomy of Michael Angelo, or the graceful gesture of the nudes of Boucher and Fragonard. Rembrandt's brush was able to grasp the psychological profundity of state of mind in his own self-portrait, just as Franz Hals captured the rotund, smug middle-class life engraved on the faces of the burgomasters he painted. But no one could seize the dynamic process of illness that has a beginning, a development and a conclusion which is at times the cosmic tragedy of death, nor could anyone depict the unfolding of a psychological process.

(21) William Hogarth (*Analysis of Beauty—Introduction*), said in 1753:

"Notwithstanding I have told you my design of considering minutely the variety of lines which serve to raise the ideas of bodies in the mind, and which are undoubtedly to be considered as drawn on the surfaces only of solid or opaque bodies: yet the endeavoring to conceive, as accurate an idea as is possible, of the inside of those surfaces, if I may be allowed the expression, will be a great assistance to us in the pursuance of our present inquiry.

"In order to my being well understood, let every object under our consideration, be imagined to have its inward contents scooped out so nicely, as to have nothing of it left but a thin shell, exactly corresponding, both in its inner and outer surface, to the shape of the object itself: and let us likewise suppose this thick shell to be made up of very fine threads, closely connected together, and equally perceptible, whether the eye is supposed to observe them from without, or within, and we shall find the ideas of the two surfaces of this shell will naturally coincide. The very word, shell, makes us seem to see both surfaces alike.

"The use of this conceit, as it may be called by some, will be seen to be very great . . . and the oftener we think of objects in this shell-like manner, we shall facilitate and strengthen our conception of any particular part of the surface of an object we are viewing, by acquiring thereby a more perfect knowledge of the whole, to which it belongs: because the imagination will naturally enter into the vacant space within this shell, and there at once, as from a centre, view the whole from within, and mark the opposite corresponding parts so strongly, as to retain the idea of the whole, and make us masters of the meaning of every view of the object, as we walk round it, and view it from without."

(22) Let us quote the opinions of some abstract American artists: George L. K. Morris: "Can you imagine it in any other time—an artist just putting shapes together—shapes that represent

nothing, either alone or in combination? He puts a frame around it, and offers it on the open market, just as a good thing to have around and look at; something that will speak to you as an independent personality, and yet is very quiet." Later on he defends the effort of self-control and pacification of "harnessing of freedom" which is the real strength of the artist. Then he compares an artist who paints Nature without selecting his themes to a "pianist who sits down on the keyboard (Whistler) or on the palette." Painting is, basically, an optical experience. Art has an emotional impulse and a structural texture, and produces two forces as different as inhaling and exhaling, and requires the impulse of the painter to activate a picture with life.

Willem de Kooning: "Abstraction first used to designate a still life led the artist to conceive of art not as something in which everything can be eliminated." "It gave some people the idea that they could free art from itself." "The artist turned his back on things in order to take possession of ideas", "social ideas, to make their objects with, their constructions the pure plastic phenomena." . . . "Man's own form in space—his body—was a private prison; and that it was because of this imprisoning misery—because he was hungry and overworked and went to a horrid place called home late at night in the rain, and his bones ached and his head was heavy—because of this very consciousness of his own body, this sense of pathos, they suggest, he was overcome by the drama of a crucifixion in a painting or the lyricism of a group of people sitting quietly around a table drinking wine" . . . "Kandinsky understood 'Form' as a form, like an object in the real world; and an object, he said, was a narrative—and so, of course, he disapproved of it. He wanted his 'music without words.'

" . . . Futurists had a simpler sentiment . . . No space. Everything ought to keep on going!

"The argument often used that science is really abstract, and that painting could be like music and, for this reason, that you cannot paint a man leaning against a lamp-post, is utterly ridiculous. That space of science—the space of the physicists—I am truly bored with by now. Their lenses are so thick that seen through them, the space gets more and more melancholy. There seems to be no end to the misery of the scientists' space. All that it contains is billions and billions of hunks of matter, hot or cold, floating around in darkness according to a great design of aimlessness. The stars I think about, if I could fly, I could reach in a few old fashioned days. But physicists' stars I use as buttons, buttoning up curtains of emptiness. If I stretch my arms next to the rest of myself and wonder where my fingers are that is all the space I need as a painter.

"Today, some people think that the light of the atom bomb will change the concept of painting once and for all. The eyes that actually saw the light melted out of sheer ecstasy. For one instant, everybody was the same color. It made angels out of everybody. A truly Christian light, painful but forgiving."

Alexander Calder: "I think that at that time and practically ever since, the underlying sense of form in my work has been the system of the Universe, or part thereof. For that is a rather large model to work from.

"What I mean is that the idea of detached bodies floating in space, of different sizes and densities, perhaps of different colors and temperatures, and surrounded and interlarded with wisps of gaseous condition, and some at rest, while others move in peculiar manners, seems to me the ideal source of form.

"I would have them deployed, some nearer together and some at immense distances.

"And great disparity among all the qualities of these bodies, and their motions as well.

"A very exciting moment for me was at the planetarium—when the machine was run fast for the purpose of explaining its operation: a planet moved along a straight line, then suddenly made a complete loop of 360° off to one side, and then went off in a straight line in its original direction.

"I have chiefly limited myself to the use of black and white as being the most disparate colors. Red is the color most opposed to both of these—and then, finally, the other primaries. The secondary colors and intermediate shades serve only to confuse and muddle the distinctness and clarity.

